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STEEL CONSTRUCTION

Pittsburgh

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THE UNITED GAS IMPROVEMENT COMPANY,

PHILADELPHIA.

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BUILDERS OF

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LOWE WATER GAS APPARATUS.

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OF

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PRODUCING { **UNIFORM RESULTS. HIGHEST EFFICIENCIES.**

THE AMERICAN
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VOL. CII., No. 7. NEW YORK, FEBRUARY 15, 1915. WHOLE No. 2,071.

DOMESTIC SCIENCE DEPARTMENT, BROOKLYN UNION GAS COMPANY.

BEAUTY AND EFFICIENCY IN HOME SERVICE.

[From the description by JEAN S. REMY.]

Ancient magic was clumsy compared to the modern magic of gas. that swift, sure and silent servitor that makes home service a science, easy and beautiful. The truth of this statement is seen as soon as you enter the artistically equipped home of the Commercial Department of the Brooklyn Union Gas Company, at 180 Remsen street, Brooklyn, N. Y.

The public had a chance to know this on January 22d. when the company gave the opening afternoon reception of the Domestic Science Department. It was "Ladies Day" in very truth; 1,500 engraved invitations had been sent out, and the crowd that thronged the building and tested its hospitality to the limit, proved that all of them had been accepted. There was the air of a big social function in the reception room, resting room and the large auditorium, all filled with eager interested visitors.

chanical device with a speck of a pilot light in every lamp in the two spacious rooms. The reception room is charming in warm ivory tones; a broad flight of stairs leads from it to the resting room, which is really a suite of three—dining room, living room and library—in truth a room where one can really rest.

The rooms are all furnished in weathered oak, with soft rugs in autumn tints and exquisite drop lights and lamps placed in "just the right place" over desks fitted up to suit the most fastidious woman, and hung alluringly over easy chairs drawn up to the tables on which interesting literature is kept.

This resting room is bound to become a fashionable centre where Brooklyn women will hold committee meetings, meet their friends, or simply drop in to rest and "while away" the moments before a matinee or tea.

Showroom, with Mezzanine in Rear and Commercial Department Offices under it.

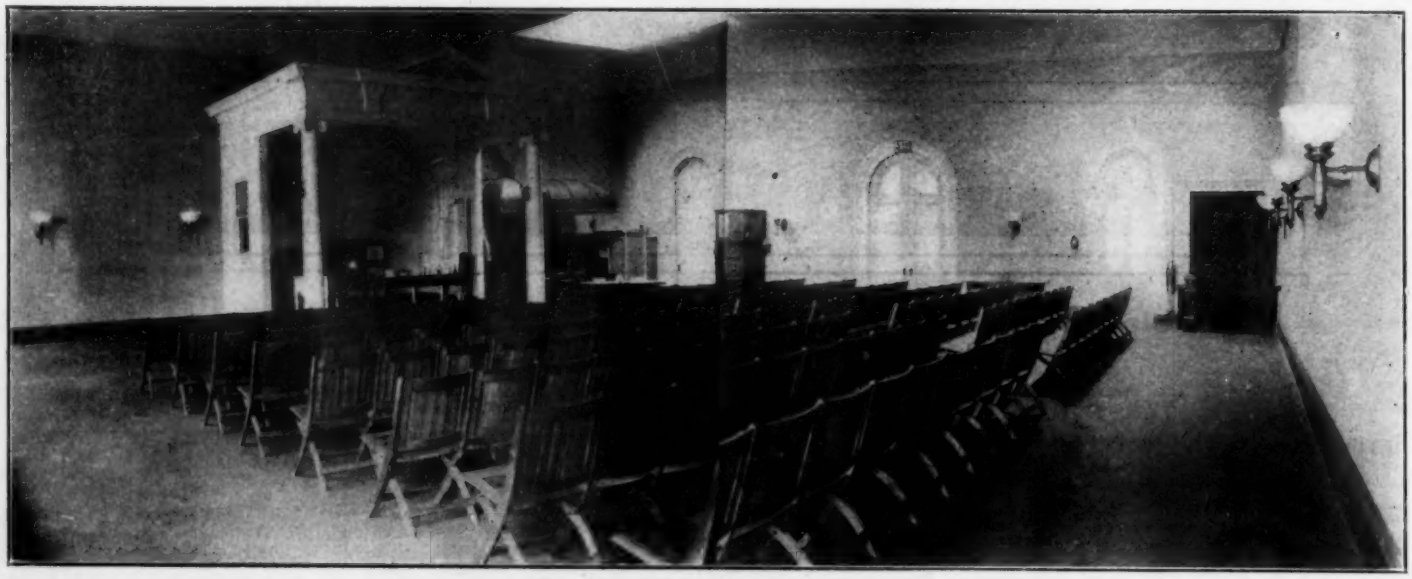
The reception committee consisted of Mrs. Eva M. Robertson, Mrs. Mary Dimpfel, Mrs. Mary O'Malley, Mrs. Adele Bishop, Miss Grace Graham and Miss Teresa Leonard, in the Domestic Science Division; and Miss Grace Alexander, Miss Antoinette Hellmund, Miss Gertrude Graham, Mrs. Mabel Clark, Mrs. Edith Kaufer, Miss Natalie Smith, Mrs. Helen Somerville, Miss Maud Johnson, Mrs. Mary Breithut, Mrs. Ellen Stringham, Mrs. Mary Melting, Mrs. Emma Halm, Mrs. Maude Ragsdale, Mrs. Mae Whiting, Miss Kathrun Hellmund, Mrs. Mae Kelly, Miss Virgie Zuck and Meesrs. E. Korthaus, D. C. Ebbets, A. K. Klein, L. N. Allen and P. Conklin of the gas company's Sales' Force.

The admirable lighting—that mellow, suffused light, possible only when gas is used—floods the reception room and resting room at the mere touch of a finger on a button connected by a clever me-

Up another short flight of stairs is the auditorium, where "Modern Magic" holds full sway under the able direction of Miss Dorothy S. Buckley, Ph.B., of the University of Chicago. Here Miss Buckley gives her lectures on domestic science in connection with the proper use of gas stoves, illustrated by practical cooking lessons in a model kitchen of pure white, equipped with every modern facility to make cooking by gas magically easy.

Magic it surely is that replaces the coal, ashes and dirt of the coal range, its banking of the fire at night and waiting for the fire to come up in the morning, with the swift turn of the lever to the left that starts instantly a brilliant, clean fire, and, presto, change, a turn to the right and the fire is extinguished.

These lectures are given daily at 2 P.M., and while Miss Buckley shows the women how to plan and cook wisely and well, she is also



Auditorium on Second Floor.

showing how to avoid gas waste, and get the most efficient results from the least expenditure of gas. The dinners that are cooked are planned for six people, and are practically meals that the women can cook and put on their own tables.

For the reception the model kitchen was transformed with decorations of palms and ferns into a lovely stage setting, from which, after an opening address by Mr. Thomas Marshall Ambler, Manager of the Commercial Department, and a welcome by Miss Buckley, an excellent musical program, under the direction of Mrs. M. C. Fuller, was rendered by the following artists:

Mrs. Maude Campbell Fuller, . .	Soprano
Mr. Harvey Self, ...	Bass
Mr. George Stehl, ...	Violinist
Mr. Harold Vincent Milligan, . .	Accompanist

In an interview Miss Buckley said: "Economy will be the keynote of every lecture I give—economy of food, of energy, of time and of gas. I believe that a woman should use the same mental effort in directing her home and planning her menus that she does in any other intellectual problem.

Rest Room on Mazzanine Gallery.

"Too many women think the home can just 'happen'; they are too casual in their management, particularly in the kitchen, where the very highest degree of scientific efficiency should be obtained.

"Keep your mind on your work and the work will keep in its place; do not let a trail of soiled cloths and dishes mark the progress of the meal preparation; wash and put in place each utensil as its use is ended; leave a spotless kitchen behind you when you enter the dining room, And about your gowning in the kitchen—be attractive; the white cotton gown is really the best to wear and can be worn many times, if proper attention to kitchen detail and management is given. Of course," said Miss Buckley in closing, "this ideal cleanliness and order is only possible when gas is the cooking medium."

During the lectures the audience is requested to ask questions of the demonstrator; conversation is encouraged, and an atmosphere of mutual helpful interest prevails. There is always a social hour after the lecture, while the articles that have been cooked are passed around on dainty china, and on Fridays a special "tea" is served in the model dining room on the messanine gallery, and it is Miss Buckley's plan to have the dining table show from time to time the correct and dainty setting proper for special occasions; the informal lunch, dainty "tea" and the formal dinner.

At the end of the cooking course of six lessons, a certificate is awarded to those completing the course, and a prize of $50 is divided each month among the women who bring in new applicants for admission to the classes.

Of course, no charge is made either for the lecture course or the hospitality of the resting room and auditorium; the service of the building and Miss Buckley's practical lessons on the use and abuse of gas in home cooking are given with the compliments of the Brooklyn Union Gas Company.

Benzol as a Motor Fuel.

The "Journal für Gasbeleuchtung" quotes some particulars of substitutes for gasoline which, it states, have acquired importance as fuels for motor vehicles because of the scarcity of petrol in Germany. The consumption per horse power developed is approximately proportional to the calorific power of the fuels. The net calorific power in B. T. U. per pound is given by Mohr for various fuels as follows: Petroleum spirit, 18,000 to 18,900; pure benzene, 17,208; commercial 90% benzol, 17,100 to 17,280; pure alcohol, 11,452; 95% alcohol, 10,575; pure naphthalene, 16,722. The following specifications for substitutes for benzol are given:

(1) Benzol-Spirit. (*a*) 95% methylated spirit, 70 parts; benzol, 30 parts. The benzol is poured slowly into the spirit while stirring—not the spirit into the benzol. (*b*) 90%, or ordinary methylated spirit, 50 parts; commercial acetone or acetic alcohol, 20 parts; benzol, 30 parts. The spirit and acetone are first mixed, and the benzol gradually added.

(2) Benzoline-Spirit. (*a*) 95% methylated spirit, 70 parts; benzoline, 30 parts. The benzoline is poured slowly into the spirit, stirring. (*b*) 90% or ordinary methylated spirit, 50 parts; commercial acetone or acetic alcohol, 20 parts; benzoline, 30 parts. The spirit and acetone are first mixed, and the benzoline added gradually.

(3) Spirit-Ether. (*a*) 95% methylated spirit, 90 parts; sulphuric ether, 10 parts. (*b*) 95% methylated spirit, 90 parts; sulphuric ether, 10 parts, naphthalene, 1 part.

(4) Acetone-Spirit. (*a*(95% methylated spirit, 70 parts; commercial acetone, 30 parts. (*b*) 90% or ordinary methylated spirit, 50 parts; commercial acetone, 50 parts.

(5) Petroleum Mixtures. (*a*) Petroleum and benzoline (petroleum spirit) mixed in proportion of 2 to 1. (*b*) Petroleum 3 parts, acetone 1 part. (*c*) Petroleum 90 parts, ether 10 parts, and 1 part naphthalene.

GAS FIRED BOILERS.

[From a paper by HERR BIRKHOLZ, read before the Westphalian Association of Gas Engineers.]

The increase in the number of gas-fired boilers makes it desirable to draw the attention of the gas consumer, more closely than has hitherto been done, to the working efficiency of such boilers and the influence which the devices for supplying the gas to the boiler has upon the effective utilization of the gas. It is frequently objected that the devices at present in use enable 4 pounds and more of steam to be generated per square feet of heating surface, and that this is perfectly satisfactory. This satisfaction, however, is ill-founded, if the output alone and not the efficiency of the boiler is high. The gases used for firing boilers in collieries and the iron industry are chiefly coke oven gas and blast-furnace gas; and these two will be considered in detail, with brief mention of producer gas, Mond gas, natural gas and coal gas only occasionally employed in steam-raising.

It is not intended to discuss whether the gas can be more advantageously utilized in large gas engines than for steam raising, although the hopes of the makers of large gas engines—who, some few years back prophesied the disappearance of gas-fired boiler and the exclusive triumph of the large gas engine—have not been fulfilled. On the contrary, gas-fired boilers have become more popular, especially for colliery work, more particularly because the question of whether the large gas engine or the steam engine with gas-fired boilers is the more economical has not yet been settled.

The Bone boiler, heated by flameless surface combustion, will be merely touched upon, boilers of this kind being still few in number; and there is no doubt that a great many tons of water will have been evaporated in existing boilers of the ordinary type before this interesting novelty will afford any noteworthy contribution to the raising of steam. Moreover, the possibility of this new type of boiler finding extensive employment is precluded, because it cannot be fired with coal in emergencies, and this possibility is one which must be possible in many establishments. Another reason for not making the change is that it is already possible, with existing gas-fired boilers, to obtain efficiencies which differ so little from those of the Bone boiler that there is no inducement to incur the expense of installing and operating the high pressure fans required for the system.

The economical working of a gas-fired boiler is naturally dependent on the efficiency of the devices for the admission and combustion of the gas, the boiler itself being of the same type as that fired with coal.

The first devices for burning gas were extremely primitive, and the usual practice was to convey the surplus gas from coke ovens—which was small in quantity at first and only increased with the improvements in and number of the regenerative ovens—to the boilers through simple pipes. The air of combustion was admitted through a few holes cut in the end wall of the combustion chamber; and no importance was attached to regulating the air supply. At that period the gas was regarded merely as a by-product, and treated accordingly; and there were no devices to ensure perfect combustion. It is evident that with these modest appliances only moderate success was attainable.

If one takes as a basis of comparison merely the heat units in the gas and in the coal, it is found that the money value of the heat in the surplus gas from a battery of 50 regenerative coke ovens will average $25,000 per annum, or approximately 25 cents per ton of coal used. In iron works the value of the blast-furnace gas is considerably higher, because the volume of gas is greater. Calculated on the basis of the coke in the furnace charge, blast-furnace gas represents a money value of $1.33, assuming the coal to be worth $2.50 per ton, so that a works consuming 150,000 tons of coke per annum will have blast-furnace gas worth $200,000. In these calculations the calorimetric values alone have been taken into consideration, leaving out of account any question of the efficiency of a gas-fired boiler being higher than one fired with coal.

In ironworks blast-furnace gas is available in large quantities, and a large number of firing appliances have been tried. These generally consisted of an external fire-box lined with refractory material, it being considered impossible to bring the low temperature gas flame into direct contact with the boiler flue without running the risk of putting out the flame through the cooling action of the flue walls. This system, however, has been abandoned, since with proper construction of the device and a corresponding air supply, the flame temperature is sufficiently high to render such fears groundless. Most of the systems of firing with blast-furnace gas are of low efficiency, due to the considerable heat developed in the fire-box and the consequent heavy losses by radiation. Huessener calculates these heat losses as at least 10%.

The efficiency of gas-fired boilers depends on the extent of the losses through radiation and in the flue gases. The most reliable method of ascertaining the losses in working steam boilers and the resulting effciency, is by measuring the water evaporated and the fuel burned over a fairly long trial period. Where in the case of coal fired boilers this determination can be had simply by weighing. the exact measurement of the gas consumed in a gas-fired boiler is attended with difficulties. The fact may also be called to mind that the efficiency of a boiler can be calculated with sufficient accuracy from the temperature and carbon-dioxide contents of the flue gases.

The useful effect of a boiler depends on the losses of heat by radiation and in the flue gases being kept as low as possible. The losses by radiation can be very considerablv reduced by suitable modification of the boiler, and in many instances where gas firing is being introduced it is proposed to provide the radiation surfaces of the boiler with an additional jacket preferably consisting of a wall of insulating brick. Further, the brickwork of each boiler should be given several coats of tar, renewed every six weeks, to prevent leaks in the brickwork. Allowance of 10% for radiation in the case of flued boilers, and 5% for water-tube boilers with the usual casing of brickwork, will be approximately correct. Of course, this estimate presupposes that the boiler is properly utilized, since the loss is not appreciably smaller for a boiler output of 2 pounds per square foot than for twice that, though in the former case the percentage loss is double. Ascertaining the losses of heat in the flue gases is much more difficult, and entails the performance of series of measurements of their temperature and carbon-dioxide content. It is generally known that the carbon-dioxide content of the flue gases affords a measure of the excess of air, on which the combustion temperature depends.

It has been ascertained that the usual effect of a boiler depends on the height of the initial temperature. In boilers of the Lancashire type, it is calculated that 70% of the evaporation is effected by the flame tubes, 25% by the second flue, and 5% by the third flue; and the proportions are similar in boilers of other types. Since, therefore, the temperature of combustion is one of the main factors, we have an indication of the value of the carbon-dioxide determination, which reveals the amount of surplus air and consequently the combustion temperature.

Whilst the activity of the makers of apparatus for measuring CO_2 enables the amount of that gas produced in working coal-fired boilers to be gauged, the question still remains in obscurity in the case of gas-fired boilers. It is well-known that 13% is the smallest quantity of CO_2 that should be present in the flue gases from a properly managed coal-fired boiler. On the other hand, the corresponding figure for gas-fired boilers is unknown, because it is first necessary to ascertain the theoretical percentage of carbon dioxide from the analyses as a guide for judging whether the actual CO_2 in the combustion gases should be regarded as favorable or not.

The first requirement to be fulfilled in gas-firing is that combustion must take place at the immediate point of entry of the gas. This is evident, because the heat absorption, and therefore the economy of a boiler, is entirely a question of the fall in temperature utilized during the passage of the heating gases from one end of the boiler to the other. Some are satisfied with the fact that a bright flame is observed throughout the whole length of the boiler flues; but such a fire is very wasteful, because, since the combustion is going on up to the end of the flues, the temperature there is still too high for any considerable amount of heat to be absorbed in the flues, and, consequently, the heating gases pass away at a high temperature and imperfectly utilized. It is disadvantageous to mount the gas burner, as is often done, inside the boiler flue, because in such case the heating effect of the gas does not commence for the first 3 feet or so from the intake end of the flue, and about 10% of the flue, or 7% of the total useful heating surface, is inoperative for heat absorption. It is advisable to mount the burner a sufficient distance back using an intermediate member if necessary—so that combustion commences immediately at the intake end of the boiler flue. The Bunsen burner is the only type which gives perfect combustion immediately beyond the point

of entry of the gas, and the Bunsen principle cannot be improved upon. In the case of boilers fired with coke-oven gas, in particular, too little importance is attached to having a non-luminous flame.

Gas firing is the most perfect of all systems, since it enables absolutely perfect combustion to be obtained, by restricting the excess of air to a minimum and thus giving the highest useful effect. All that is necessary is to control the air supply so that the gas combustion is complete and takes place immediately at the point of entry; and that all needless excess of air is precluded. The points to be taken into consideration in constructing and economically operating such boilers are as follows:

(1) The primary air of combustion should be brought into contact with the gas at such an early stage that an intimate mixture of gas and air is produced by the time they reach the seat of combustion, and that complete combustion and maximum flame temperature are attained at once and within a minimum distance.

(2) The air supply must be so arranged that the quantity of air necessary for complete combustion enters independently of the chimney draught, whilst the velocity of the gases can be lessened by throttling the chimney damper, in order to lower the temperature of the flue gases as much as possible, without fear of unduly lessening the air supply.

The first point is settled in an ideal way by the Bunsen burner principle, which enables the combustion temperature to be approximated to the theoretical standard. As already stated, the heat absorption of a boiler is solely a question of time, since the velocity of the gases of combustion must be regulated so that as much as possible of their contained heat can be allowed sufficient time to be absorbed by the walls of the boiler. The only way in which this condition can be satisfied is by having the combustion independent of the chimney draught. When the air of combustion is drawn in by the suction of the chimney, it is necessary to keep the damper wide open to secure sufficient air for the combustion. This means that under the influence of the chimney draught, the products of combustion pass through the boiler quickly and enter the chimney flue at a high temperature.

The manner in which the Terbeck burner endeavors to accomplish the above-mentioned purpose will now be discussed. This burner is a large properly dimensioned Bunsen burner, the gas entering the mixing tube through an annular nozzle of accurately calculated area, without much loss of pressure, and drawing the primary air in after it, through a centrally arranged disc valve, an intermate mixture of the gas and air being produced during their passage through the mixing tube. Owing to the possibility of accurately measuring the inflowing gas and air, the most favorable velocity for producing an intimate mixture in the mixing tube can be obtained. The effluent velocity of the gas-air mixture is increased by the taper at the delivery end so that lighting back is impossible under ordinary working conditions. Since the whole of the air required for combustion cannot be drawn in by the energy of the inflowing gas, secondary air is admitted—drawn in to some extent by the outflowing gas-air mixture—all round the seat of combustion. The intakes for both gas and air can be accurately adjusted. As the gas pressure fluctuates, the indrawn air is regulated automatically in so far that, as the pressure increases, the resulting increased energy of the gas draws in a corresponding larger quantity of air, and *vice versa*.

The only conditions under which Bunsen burners can give rise to explosions are when the gas leaves the burner without being ignited, in which cases the mixture of gas and air formed in the flues explodes; or where sudden increases of pressure impart such high velocity to the gas that the velocity of ignition of the gas-air mixture is lower than the effluent velocity of the mixture, in which event the flame is naturally disrupted and the conditions precedent to an explosion are set up. Against the former contingency there is no remedy, so long as one has to rely on workers whose intelligence is a variable quantity. The second possibility can be guarded against by providing in the gas main a safety valve which will close when the pressure reaches say 3¼-inch gauge, which pressure must, of course, be taken into consideration in calculating the burner. It is also advisable to set up chequer work about 6 feet away from the mouth of the burner. Once this has become hot it will re-ignite the gas should it be momentarily extinguished.

The working efficiency of gas-fired boilers will be discussed with reference to the Terbeck burner, and in place of merely giving data from personal experience I prefer to cite expressions of opinion by a number of gentlemen in the iron industry. In 1911 Hoff reported a trial with one of the first Terbeck burners built in the flue of a boiler, and gave the efficiency at 65%. Last year Ortman gave particulars of trials in which the volume of gas consumed was accurately measured by means of a gasometer, and which gave efficiencies of 74.9 and 80.2% with coke-oven gas. The steam generated per cubic feet was 0.24 pounds and 0.28 pounds respectively. Three further trials with blast-furnace gas in an ordinary flue boiler, gave efficiencies of 76.8, 78.4 and 82.7%. so that a mean efficiency of 78 to 80% can be counted on. One cubic foot of gas evaporated 0.074 pounds of water; and the amount of CO_2 theoretically possibly in the products of combustion, for perfect combination without excess of air was 25%, whereas the analysis of the gases gave 23.3 to 24.1%, corresponding approximately to the 10% excess of air calculated for in designing the burner.

Huessener reported an evaporation trial of 288 hours giving an efficincy of 82%, each cubic foot of blast-furnace gas producing 0.082 pounds of steam. This experimenter stated that when perfect combustion is attained with a minimum excess of air, a relatively low final temperature of the flue gases can be attained by setting the damper properly; and that he himself had seen, at a large German ironworks using the Terbeck burner, the temperature of the effluent flue gases reduce from 300° C to 220° C in a quarter of an hour by simply lowering the damper. In the trial in question the temperature of the effluent gases ranged between 150 and 170° C, and the percentage of CO_2 was about 15%, the theoretical maximum value being 19.3%. The CO_2 was determined in front of the damper, where a large excess of air was present, owing to leaks in the brickwork, whereas to obtain a proper idea of the operation of the burner it is necessary for the readings to be taken where errors caused by a defective condition of the boiler are impossible—that is at the end of the flue or behind the first nest of tubes in water-tube boilers. The burner was not touched during the whole 288 hours occupied by the trial, but provision was made for ensuring uniform gas pressure by installing a special fan; and such precaution is advisable where the gas pressure is liable to considerable fluctuation. In the case of high fluctuating gas pressure it is a good plan to employ a pressure regulator.

These results can be obtained without pre-heating, and if the firing be properly managed the temperature of the effluent flue gases is so low that pre-heaters of the ordinary type are hardly profitable to install. Huessener also stated that there is no doubt but that the efficiency of gas-fired boilers can be increased to 90%, by employing mechanical pressure regulators, by providing air heaters, by giving the brickwork a thick coating of tar to keep out undesired air, and finally by employing water-tube boilers with low radiation losses.

These are the opinions of gas users on the efficiency of boilers fired with coke-oven gas and blast-furnace gas. Brief mention may also be made of a trial of a Stirling boiler, with a heating surface of 3,765 square feet, a super-heating surface of 1,075 square feet, and a working pressure of 176 pounds. The trial was conducted by a boiler inspection association and lasted for 8 hours. The theoretical percentage of the CO_2 in the combustion gases, as determined from the composition of the blast-furnace gas and leaving the surplus air out of consideration, was 22.2%. The consumption of gas per square foot per hour was 72 cubic feet, generating 56 pounds of steam. The flue gas, taken from behind the first nest of tubes, contained 21.5% of CO_2, a value corresponding to less than 10% of excess air. The heat balance sheet gave the utilized heat as 79.5%. the loss in the chimney stack being 8% and the radiation losses 12.5%.

In one boiler plant a useful effect of 85% has been obtained in continuous running with coke-oven gas, and it will be admitted that similar results will be easily attainable, at least with water-tube boilers, when the radiation losses can be brought down to 5%; indeed, Neumann reckons with radiation loss of only 3.5%, and loss in the effluent flue gases of 8 to 10% with the Bone boiler.

In conclusion, the value of the determination of CO_2 in the methods of combustion may be briefly elucidated. The author is convinced that the use of CO_2 recording apparatus is just as desirable as in the case of firing with coal. If, however, the fireman is instructed to make one or two CO_2 determinations per diem and to record the temperature of the waste gases from each boiler every two hours, a sufficient check for practical purposes will be obtained.

It may be objected that the Orsat apparatus or the Bunte burette is too complicated for the boiler attendant; but there are now obtainable apparatus which enable the CO_2 to be determined in half a minute. Mention need only be made of the CO_2 thermoscope, which has often rendered the author good service in testing boiler plants. This apparatus is based on the fact that caustic soda absorbs CO_2, and liberates an amount of heat corresponding to the quantity of CO_2 absorbed. This increase in temperature gives a

fairly accurate idea of the CO_2 present, and the temperature of the effluent gases can be taken by an electric telethermometer. The CO_2 content depends on the composition of the gas, and since it is the determining factor for complete combustion efficiency, guarantees are generally based on the attainment of a CO_2 content which corresponds to an excess of 10% of air.

For this purpose it is necessary to calculate the theoretical maximum value from the analysis; and a calculation of this kind, based on blast-furnace gas, is appended. Analysis of the gas gave the following composition:

	Gas Anaylysis. Per Cent.	Oxygen needed. Per Cent.	CO_2 in Effluent Gases. Per ent.	Nitrogen. Per Cent.	Heating value. cal. per cubic metre.
CO_2	6.0	....	6.0	....	....
O_2	0.3	....	....	....	....
CO	24.2	12.1	24.2	....	648.4
H_2	6.2	3.1	....	....	184.7
CH_4	0.4	0.8	0.4	....	31.7
N_2	62.9	....	....	62.9	....
	100.0	16.0	30.6	62.9	864.8

The theoretical quantity of air required is therefore: $16 - 0.3\ (O_2) + 59.2\ (N_2) = 74.9$, or $= 0.749$ per cubic metre of gas.

The waste gases have the theoretical composition:

CO_2	30.6
N (59.2 + 62.9)	122.1
	152.7

Experience shows that the Terbeck burner requires an air excess of about 10%; that is to say, 0.8239 cubic metre of air is needed for the complete combustion of 1 cubic metre of gas.

Under these conditions the composition of the waste gas works out as follows:

CO_2	30.60
N_2	122.10
O_2 in excess air	1.57
N_2 " " "	5.92
Total combustion products (water vapor omitted)	160.19

Hence, with proper combustion, the CO_2 content of the effluent gases should be:

$$\frac{30.6 \times 100}{160.19} = 19.1\%$$

For coke-oven gas the calculation is performed in the same way.

The author has selected this analysis taken from his own experience in practice. At the plant in question he found only 12%, instead of 19% of CO_2 in the effluent gases, at an effluent temperature of 350° C. By improving the burners it was found possible to increase the number of boilers heated with the available blast furnace gas from 10 to 13. Since this enabled three of the boilers previously fired with coal to be fired with gas, and since a boiler with a heating surface of 1,075 square feet consumes about 2,000 tons of coal per annum, the saving effected by changing the burners was equivalent, with coal $2.50 a ton to about $15,000 per annum. It is therefore advisable to examine gas-fired boiler plants on the lines suggested above; more particularly since in most cases the CO_2 determination has not yet been applied to gas-fired boilers, and experience shows that such examination gives values which can be considerably improved by suitably modifying the firing arrangements. In nearly every case it is possible to obtain an efficiency of 75% with flue boilers, and 80 to 88% with water-tube boilers. If examination of a plant shows that the usual effect is not high enough, the question arises, what burner should be used to improve the efficiency? It might naturally be expected that the author would always recommend the Terbeck burner, but he urgently advises that no system of burner be employed unless clear guarantees are given, not only in respect of the evaporative effect produced, but also on the useful effect of the boiler and the percentage of chimney losses. It may be objected that the usual effect of a boiler is dependent on a number of factors on which the firing apparatus has no direct influence; but against this, the author would point out that engineering firms who desire to construct gas-firing devises ought to have a wide experience, so that in each individual case they may be able to produce or arrange for the conditions which are essential to the attainment of proper efficiency.

Ammonia Plant for Russian Gas Works.

From Our Own Correspondent.

PETROGRAD, January 9th, 1915.

Under stress of shortage of supply of raw material for the color industry, the Russian chemical industrialists are turning their attention with more earnestness than ever before to the possibilities of home supplies. The coal tar item, being of exceeding importance, is receiving particular attention, and although in the South at the coking ovens of the Donetz basin large quantities are made in the process of producing coke for several extensive Russian metallurgical works, it is felt that the gas works that exist in Russia have not turned their's to as good account as might have been the case. For example, it is only at the Warsaw gas works that any serious effort has hitherto been made to recover for color-making purposes the by-products of gasification, and there considerable quantities of coal tar are saved for use in the chemical works, etc. As the Warsaw gas works, which, by the way, belongs to a German combination, turns out something like a third of the total coal gas produced in Russia, it may be said that as far as the gas works in the country are concerned the coal tar recovery problem is solved to the extent of only one-third. But there are other large gas works where economy of by-products is sadly in want of attention, both at Petrograd and Moscow. At the latter works, however, a contract was entered into shortly before the beginning of war for laying down an ammonia recovering plant and other equipment for utilising what was once waste. Unfortunately the war interfered with the execution of the contract which, under the circumstances, must remain either inoperative while the war lasts or must be cancelled in favar of contractors either in Russia or some friendly or neutral country. One Russian chemical engineering house was willing to undertake the work, but it does not appear yet to have been put in hand. There was a feeling, it is said, that loyalty to the contract with the German engineers constrained the Moscow authorities to decline this assistance, but the latest news is the fact that the delicacy in respect to the contract with the Germans is being overcome, and that either home houses or some house belonging to friendly country will have the work to do, for it is recognized as an item of great importance in the Moscow gas works economy.

There are only some 20 gas plants in Russia altogether, and as the Warsaw works supply about a third of the total, if we except the works of Petrograd and Moscow, we find the remaining 17 are relatively small concerns. Warsaw's delivery of gas is 36 million cubic meters per annum, that of Moscow 13 millions, and Petrograd 19 millions. Totalling these three there is a very small margin to be divided amongst the 17 others.

Government Is Not Business.

One of the speakers at the annual meeting of the Academy of Political Science, held recently in New York, advanced the theory that "a constitutional government is a corporation organized to carry on public business," and that "the managers of a public corporation have much the same kind of business problems as the managers of private corporations."

There could be no greater error, says the New York "World." Government is not business, and business is not government. If business were managed the way government has to be managed, it would soon go into the hands of a receiver. If government were managed the way business is managed there would be a revolution.

There are certain technical business problems in government, but curiously enough, the men who are most successful in solving them are not business men. The business man is usually a failure in government because he treats government as a business; and for a similar reason the successful statesman is rarely a competent business man. The great Secretaries of the Treasury, for example, Hamilton, Gallatin, Chase and McCulloch, were notably deficient in so-called business ability; and with very few exceptions millionaire business men who have gone to the United States Senate have found themselves wholly out of their element. Lincoln could save the Union, but the Illinois Central Railroad regarded his legal services as practically worthless.

The business of business is to show a profit; but the business of government is to promote the general welfare, and the general welfare cannot be reduced to dollars and cents or to any tangible matter of bookkeeping.

THIRTEEN YEARS OPERATION OF INCLINED RETORTS.

[From the paper by MR. FRANK HUBER, read at A. G. I. Meeting.]

The installation at Louisville, Ky., was designed and constructed under the direction of Mr. A. H. Barret, chief engineer of the Louisville Gas Company; and consisted of 20 benches of 6's, 15x23-inch top, 15x26-inch bottom, 18 feet long, in 2 stacks of 10 benches each—placed parallel, with a space of 25 feet between stacks and 13 feet 10 inches working space between the benches and wall of building on discharging floor. The distance from the ground level to the discharging floor is 13 feet and to the charging floor 27 feet 9¼ inches.

Above the charging floor are 2 rows of coal hoppers, 20 in all, capable of holding 48 hours supply. The coal is received in the storage shed (10,000 tons capacity), then hauled by 2.45 ton cars on narrow gauge track to receiving hoppers, where it is broken and elevated and distributed into the hoppers. Each bin has a slide valve operated from the charging floor, for loading the portable retort chargers, of which there are 4—2 to each stack—suspended from the tracks above the benches. Each charger has 3 magazines ofr coal for bottom, middle and top retorts.

The coke is drawn from retorts to chutes in discharging floor, then drops to cars on ground floor which are pushed to quenchers, snd then to elevator, and to coke warehouse with capacity of 50,000 bushels, divided into 5 compartments as follows: 22,000 bushels of lump coke, and all sizes as it comes from the retort houses; 11,000 bushels of egg coke, 1½ to 2 inches; 5,700 bushels of nut coke, ¾-inch size; 5,700 bushels of breeze, and 5.700 bushels of pea coke, ⅜-inch size.

The lump coke, as it is taken from large bin, passes over perforated chutes, and all coke 2 inches under drops into pockets and ia conveyed to hopper at end of coke house, where it is re-elevated to the top, and there separated by a revolving screen, dropping into bins as per sizes noted above.

The erection of the inclined retort house was started during 1899, and installation completed in 1900: began carbonizing coal August 9th, 1900, and continued until March 20th, 1914, when artificial gas was displaced by natural gas.

Dampers.—On each bench are 4 flue dampers located at grade line: 2 in front, and 2 back of bench. The discharging side of bench is called the front, and the charging side, the back. The flue openings are each 5 inches x 20 inches. The flue dampers are to regulate the pull on the setting, and are closed when bench is not in use. These flues extend down to flues 15 inches x 18 inches, running under center of bench and out into main flue to chimney 4 feet in diameter extending 75 feet 6 inches above damper line. The draft in the chimney 3 feet above grade, gave 6/10 inch water pull; over top of tile damper at grade line, with front slides open 6 inches, there was 0.25-inch water, and with the back dampers open 5 inches, the pull was 0.2-inch water. With this draft, primary dampers were opened in back of bench 2¼ inches on each side; in front of bench, 1 inch on each side; making total area of 4 openings 27.62 square inches. Secondary dampers open in back of bench, 2½ inches on each side, and on front of bench 1¼ inches on each side, making a total for the 4 openings of 29.74 square inches. Air velocity at primary and secondary dampers was taken with an anemometer fixed to a box which fitted around opening, and the result used for a check on all benches.

Generators are inside of bench, and clinkered every 24 hours. Fig. 1 shows clinker door, relief bar door, secondary and primary air dampers and recuperator. The fuel bed averaging 6 feet deep, and with dampers set as just described—the furnace lid being open —a flame would hover in and out of the furnace door. The lower combustion chamber indicated 0.05 inch of water pull, the upper combustion chamber showing slight pressure.

The upper and lower combustion chambers were divided with a wall starting at the nostrils over the generator, and extending up around retorts to arch of bench, thus making each combustion chamber independent of the other. Tiles were placed over nostrils of upper combustion chamber, as conditions required, to regulate heats.

Outlet ports for waste gases into recuperators were closed two-thirds of the way by sliding tiles down from the top, thereby forcing the hot gases from upper combustion chambers up around retorts, and down under the bottom retorts to lower outlet ports. This was done to utilize the heat as much as possible from the upper combustion chambers, along with the lower combustion chamber waste gases, it being necessary to carry the heat high in the lower part of the retorts, due to the charges being the thickest at the shields. The above regulation could be changed by sliding damper, which was necessary at times according to grade of coal used.

Fig. 1.—Clinker and Relief Bar Doors, Dampers and Recuperators.

Charging.—Heats were brought up with damper regulations as described, and retorts charged light, gradually increasing the heat and also the charge. We started carbonizing 625 and 650 pounds of coal in 4 hours, but changed to 700 pounds in 5 hours, and then 750 pounds in 5 and 6 hours; the working basis being 5 hours. Charges were changed according to grade of coal received.

Working in Retort House.—The force, 12 hour shifts, was as follows:

1 Head stoker, or foreman—Day and night.
4 Stokers—Day and night.
3 Coke-car men—Day and night.
1 Hydraulic main man—Day and night.
1½ Clinkermen—Day only.
1½ Clinker helpers—Day only.

The stokers charged and discharged 9 retorts per hour per gang, keeping standpipes open, filling furnaces and leveling off coke, cleaning floors and helping head stoker. The head stoker, in charge of retort house, kept the pipes burnt out, scurfed and patched retorts and made out reports. Coke men ran cars under chutes receiving coke from retorts, quenched coke and took same to the coke house. Hydraulic main men drew off tar once a day, keeping on seals, and had helpers 2 hours in the afternoon to clean out heavy deposit.

Stokers were carbonizing 10⅛ tons of coal per man per 12 hours, corresponding to 3 charger loads per gang of 4 men per hour. In establishing this basis of work, it was understood that 3 loads per gang of 4 men was the quantity of coal per hour, and it was necessary at different times of the year to reduce or increase carbonization, and proportion of work as it might be. We have had 4 and 3-men gangs, and at times 2 4-men and 1 2-men gangs. The 2-men gangs would draw and charge in proportion. During the hot summer of 1901 we had to reduce this task work from 9 retorts per hour per gang of 4 men to 6 retorts 1 hour and 9 the next hour.

In August, 1911, a strike ensued, and the outcome was a compromise on a 10-hour basis, *i. e.*, they drew and charged the same amount of coal per hour, but discontinued breaking down furnace fuel and helping head stokers burn out pipes and clean up floors. This necessitated one extra man on each watch.

The results obtained naturally were best when new, and the most troublesome part of the operation was maintaining heat. This was very noticeable in 1904, when it was found that the combustion walls in stack No. 2 were sagging in and closing off draft.

While the retorts and other parts of the benches were in good condition, we tore out these settings and renewed retorts in benches 1, 2, 3, 4, 5 and 6—stack No. 2, and started bracing walls of combustion chambers of the balance of benches, and extended their life, as will be seen by the duration charts, Figs. 2, 3 and 4.

Fig. 6 shows combustion chamber walls before bracing. It was surprising to note that the retorts did not sag more than ordinar-

No of Bench	Date Retorts Renewed	Began Carboniz'g	Let Down	Carboniz'g Resumed	Let Down	Carboniz'g Resumed	Let Down	Total Duration of Bench	Condition of Setts Sag Back	Sag Front		Remarks
1											upper middle lower	Bench Good on 5 hrs charges Letting down Good for 1yr more
2	1908 October	Oct 15th 1910	March 20th 1914					3years 5months 5 Days	4" 2" 1/8	5" 3½ 2"	up Mid Low	Bench Good on 5 hrs charges before letting down. Good for 3 years more service
3	1908 October	Oct 4th 1910	March 20th 1914					3years 5months 11 Days	6½ 4 1½	6½ 4½ 2½	up Mid Low	Bench Good with 5 hrs Charges before Letting down Good for 1yr more Service.
4	1908 November	Oct 15th 1909	March 20th 1914					4years 5months 5 Days	4¼ 3¼ 1/8	4¼ 3 1/8	up Mid Low	Bench Good on 5 hrs Charges When Let down Good for 5 yrs
5	1908 Sept	Oct 16th 1908	March 20th 1914					5years 5 months 5 Days	4¼ 3 1/8	5½ 3 1/8	up Mid Low	Heats Good 5 hrs charges before Letting down Good for 5 years more
6	1909	Oct 14th 1913	March 20th 1914					- years 5 months 7 Days	½ - -	1 ¼ -	up Mid Low	Bench in Very Good condition
7	1905	Jan 28th 1906	March 28th 1908	Sept 29th 1906	April 15th 1913	Oct 16th 1912	March 20th 1914	7years 5months 23 Days	6 3 2	5 2 -	up Mid Low	Bench Good with 5 hr Charges before Letting down was need new setting
8	1905 Jan	Jan 2nd 1906	March 20th 1914					8years 2 months 19 Days	7 5 1	6½ 4 1½	up Mid Low	Bench doing fair on 5 hrs will need new Setting
9	1905 Jan	Dec 1st 1905	March 20th 1914					8years 3 months 20 Days	6½ 4 1½	7 5 1½	up Mid Low	Bench doing fair on 5 hrs will need new Setting
10	1904 Sept	Dec 4th 1904	Jan 6th 1905	Oct 7th 1905	April 15th 1913			7years 7 months 5 Days	6 4½ 2	5½ 3½ 1½	up Mid Low	Bench will need new Setting

Fig. 2.—Duration Chart. Stack No. 1; First Setting.

No of Bench	Date of Erection	Began Carboniz'g	Let Down	Carboniz'g Resumed	Let Down	Carboniz'g Resumed	Let Down	Duration of Bench	Condition of Setts Back	Sag		Remarks
1	1900 January	June 15th 1903	January 1st 1903	September 4th 1905	March 7th 1907	October 1st 1907	March 20th 1914	6years 7months - Days	7/8 4½ 1/8	7 3½ 3/4	up Mid Low	Braced walls of combustion chamber Feb 1905 Bench in Good condition
2	1900 January	January 3rd 1901	January 23rd 1901	Sept 23rd 1901	March 13th 1905	Sept 9th 1905	March 23rd 1907	5years - months 20 Days	3 2 1	5 3½ 2	up Mid Low	Retorts torn out combustion chamber walls braced
3	1900 January	December 30th 1900	April 26th 1901	Sept 13th 1901	July 29th 1905	Sept 17th 1905	April 11th 1907	5years 8months 6 Days	5 4 -	4½ 3 1/4	up 4	Same as Bench 2
4	1900 January	Sept 30th 1900	April 15th 1907					6years 6months 11 Days	6 4 1	6½ 3½ 1/8	up Mid Low	Retorts torn out
5	1900 January	Sept 27th 1900	Mar 1913 1905					7years 5months 18 Days	6 4 1	6½ 4½ 1/8	up Mid Low	Retorts torn out
6	1900 January	Sept 27th 1900	April 28th 1903	Oct 14th 1903	Dec 22nd 1905	Feb 4th 1906	March 22nd 1909	6years 10months 23 Days	6½ 5½ 1/8	6 4½ 1/8	up Mid Low	Relined furnace walls Jan 1906 4½ High Combustion Chamber walls out
7	1900 January	Oct 3rd 1900	April 2nd 1903	Sept 5th 1903	Nov 14th 1904			3years 8months 8 Days	4½ 2½ 1	3½ 2 1	up Mid Low	Tore out Retorts
8	1900 January	Dec 30th 1900	Feb 23rd 1903	Sept 4th 1903	Nov 13th 1904			3years 4 months 2 Days	4 2 1/8	3½ 2½ 1	up Mid	Tore out Retorts combustion walls out
9	1900 January	Dec 31st 1900	March 4th 1903	April 7th 1903	July 4th 1903	Aug 24th 1903	Oct 31st 1904	3years 7months 2 Days	5 3 1/8	4½ 2½ 1	up Mid Low	do
10	1900 January	Oct 7th 1901	Aug 10th 1903					2years 10months 12 Days	4 3 1/8	3½ 2 1	up Mid Low	Tore out Retorts Combustion Chamber walls out

Fig. 3.—Duration Chart. Stack No. 1; Second Setting.

No of Bench	Date of Erection	Began Carboniz'g	Let Down	Carboniz'g Resumed	Let Down	Carboniz'g Resumed	Let Down	Duration of Bench	Condition of Setts Back	Sag		Remarks
1	1900 January	Sept 4th 1900	Feb 2nd 1901	Aug 30th 1901	Feb 18th 1903	July 19th 1903	Feb 6th 1904	2years 5months 12 Days	4 3 1/8	3 4 1/8	upper middle lower	Tore out Settings down to A Recuperators Rest up Combustion Chamber walls Retorts Furnace 4½ high
2	1900 January	Aug 31st 1900	May 2nd 1903	July 31st 1903	Feb 23rd 1904			3years 6months 4 Days	4½ 2¼ 1/8	3½ 2 1/8	up Mid Low	Same as Bench 1.
3	1900 January	Aug 18th 1900	Mar 23rd 1902	July 24 1903	April 4th 1904			3years 8months 3 Days	5 2 1/8	3½ 2½ 1	up Mid Low	Same as Bench 1.
4	1900 January	Aug 23rd 1900	Mar 9th 1901	Aug 29th 1901	April 17th 1903	Feb 25th 1903	April 19th 1904	2years 8months 26 Days	3½ 2½ 1/8	3½ 2 1/8	up Mid Low	Same as Bench 1.
5	1900 January	Aug 18th 1900	Mar 18th 1901	Aug 24th 1901	Nov 16th 1901	Sept 29th 1903	May 2nd 1904	2years 8months 12 Days	3½ 3 -	4 3½ 1/8	up Mid Low	Same as Bench 1.
6	1900 January	Aug 16th 1900	April 23rd 1901	Aug 24th 1901	July 5th 1902	Oct 4th 1902	July 12th 1904	3years 8months 27 Days	5 3 1/8	4½ 2½ 1	up Mid Low	Same as Bench 1.
7	1900 January	Aug 23rd 1900	July 15th 1902	May 14th 1904	Feb 28th 1906	Sept 18th 1906	March 20th 1911		6½ 2 1/4	7 4½ 1/8	up Mid Low	Furnace relined, restricts over furnace relined, Combustion Chamber walls braced, Retorts fair
8	1900 January	Aug 28th 1900	July 23rd 1902	Jan 9th 1904	Feb 7th 1906	Sept 10th 1906	March 13th 1911	8years 3months 23 Days	- - -	- - -	up Mid Low	Furnace relined 4½ high Combustion Chamber walls braced, Work in fair condition
9	1900 January	Aug 31st 1900	July 28th 1902	Oct 5th 1903	Feb 1st 1906	Sept 10th 1906	June 29th 1909	7years 6months 25 Days	6½ 1/4 1/8	7½ 5½ 1/8	up Mid Low	Bench settings torn out Furnace relined 4½ high
10	1900 January	Sept 4th 1900	Nov 25th 1901	May 26th 1903	Jan 5th 1906			5years 10months - Days	5 4 1/8	6 3 1/8	up Mid Low	Bench torn down to combustion chamber walls with new recuperators

Fig. 4.—Duration Chart. Stack No. 2; First Setting.

No of Bench	Date Retorts Renewed	Began Carboniz'g	Let Down	Carboniz'g Resumed	Let Down	Carboniz'g Resumed	Let Down	Total Duration of Bench	Condition of Setts Back	Sag		Remarks
1	1904 April	June 25th 1904	Oct 31st 1904	Nov 29th 1905	Nov 29th 1906	Nov 1st 1907	Mar 20th 1914	8years 8months 19 Days	Best 2" -	Best 2" 2½ 1"	up Mid Low	Bench Good with 6 hr Charges Before Letting down
2	1904 May	Aug 22nd	Nov 20th 1906	Sept 15th 1907	Mar 20th 1914			8years 9months 5 Days	6 4 1/8	7 5 1/8	up Mid Low	Bench good on 6 hrs Before Letting down
3	1904 June	Aug 24th 1904	April 28th 1906	Sept 10th 1907	Mar 20th 1914			8years 2months 8 Days	4½ 4 2½	6 4½ 1/8	up Mid	Same as Bench 2
4	1904 July	Sept 3rd 1904	April 15th 1906	Sept 3rd 1907	Mar 20th 1914			8years 1month 11 Days	5 2 1/8	4½ 2 1	up Mid	Same as Bench 2
5	1904 Aug	Sept 19th 1904	April 16th 1906	Nov 22nd 1906	Mar 20th 1914			8years 11months 4 Days	5½ 1½ 1/8	5 2 1½	up Mid Low	Same as Bench 2
6	1904 Aug	Oct 1st 1904	Mar 8th 1906	Nov 18th 1906	April 13th 1911	Oct 13th 1911	Mar 20th 1914	8years 5months 5 Days	6 2½ 1/8	5 3 1/8	up Mid Low	Bench Good on 7 hrs before Letting down
7		Oct 14th 1911	April 24th 1913	Oct 16th 1913	Mar 20th 1914			10years 1month 11 Days	8½ 6 5	9 5½ 1/8	up Mid Low	Bench Good on 5 hrs before Letting down new Setting required
8										4 1½ 1	4 3 2½	up Mid Low	Bench in good condition for use
9	Aug 1909	Dec. 19th 1909	April 14th 1911							- - -	- - -	up Mid Low	Same as Bench 8
10	April 1900	Sept 10th 1906	Mar 8th 1909					2years 5months 29 Days	1 1/8 -	1½ -	up Mid Low	Same as Bench 8

Fig. 5.—Duration Chart. Stack No. 2; Second Setting.

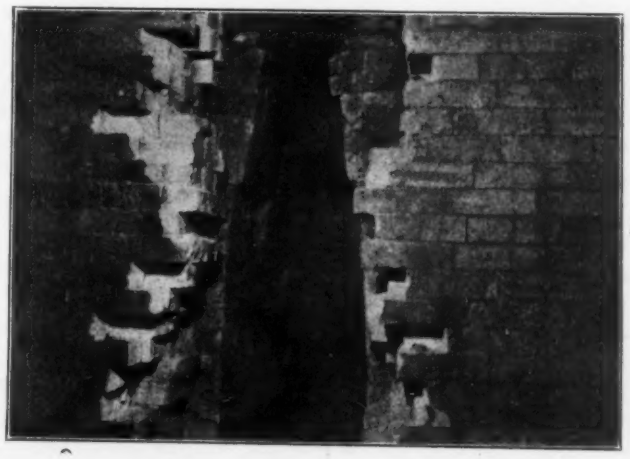


Fig. 6.—Combustion Chamber before Bracing.

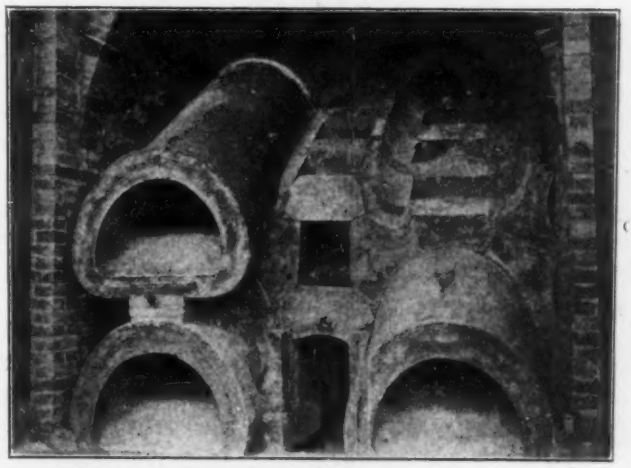


Fig. 7.—Arch Tile Settings.

ily, with the combustion chamber walls in the shape shown, as these walls formed the base of center setting. This can be accounted for by referring to Fig, 7, where it will be seen that each saddle forms an arch around retorts, and weights above are transmitted to side walls, having a tendency to hold saddle of upper retorts, lower inside portion of bottom retort acting as skew-back.

The failure to detect the caving in of combustion chamber walls explains why the life of these benches was not longer.

In renewing settings, we lowered the base and brace tiles, as is shown in Fig. 8, bringing the tiles on a line with bottom of retort, instead of as in Fig. 7. The duration charts show that benches ran from 2 years 5 months to 10 years, averaging 5 years 5 months, and I feel safe in saying that an average of 6 years could have been attained had more bracing been provided in combustion chamber.

Patching Leaks.—Benches after being let down and fired up several times, gave quite some trouble due to expansion and contraction, leaks in recuperator partitions occurred, short-circuiting the secondary air into waste gas side, causing heats to drop and fuel to increase. These leaks usually occurred in the vertical joints of partition tiles (see Fig. 1) within 4 feet of main damper, and were patched through openings in benches provided for cleaning and inspection. As most of the leaks were low, they were patched from either the primary or secondary air opening, front or back. For finding this short-circuiting we made a leak detector of a piece of ½-inch pipe, about 12 feet long, with gas hose and a burner tip on end of pipe. The pipe would be inserted in the horizontal flue passing the end over each joint, and wherever there was a leak the flame would be sucked in. A note was made of all leaks, and when benches needed attention examination would be made of leaks previously patched.

(*Continued on page 106.*)

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NEW YORK, MONDAY, FEBRUARY 15, 1915.

Gas Troubles in England.

Two notes in English gas journals call attention to some of the difficulties of operating during war time.

One of these is the taking of works employees for service in the army. Under date of December 3rd, the Secretary of the Institution of Gas Engineers, sent the following letter to the War Office, Whitehall:

"The attention of the Institution of Gas Engineers has been called to the somewhat serious situation which has arisen in some districts owing to so many men in the service of gas undertakings having joined the colors. Should this depletion continue there will be difficulty in maintaining the public supply of gas. While recognizing the great necessity for every available and suitable man joining the army at the present moment, may I enquire whether the authorities have considered the advisability of providing for the necessary number of men being retained to carry on the operatians for continuing the gas supply of the country?"

The Director of Recruiting replied on December 18th:

"In reply to your letter of the 3rd instant, I am directed to inform you that recruiting officers have been instructed that on no account should *skilled employees* of concerns such as gas, electric light and power corporations, water works, tramways, etc., be accepted for enlistment unless they are in possession of a certificate from their employers that their services can be spared. In the case of those employed on *unskilled labor*, reasonable time will be given for relief to be found from men who are unfitted for service before they are accepted."

An even more important matter is that of coal supply. The London "Times" gives a list of 34 enemy ships detained in United Kingdom ports, which it says the Admiralty proposes to put into the East Coast coal trade, with a view to relieving the situation caused by the short supply of tonnage, the delays in port and the consequent difficulty of getting coal to London. The method of using the steamers is, however, being criticised. At a conference between the Admiralty and the gas and electric companies and coal merchants it was suggested that these steamers be apportioned to the public service companies according to their needs, and to the shipping companies in proportion to the numbers acquired. This plan, however, was not adopted. The vessels seemingly are to be put into the open market and chartered to the highest bidders. As compared with the low rates of 2s. 9d. or 3s. per ton quoted before the war, a freight of 13s. 9d. is now current. The placing of the vessels in the open market may possibly have the effect of causing rates to become easier; but there is a feeling that a more effective way of using the vessels to the best advantage of the public would have been to distribute them according to the needs of the great public service companies. Certain of the gas companies are believed to have coal supplies for only about ten days; and additional steamers are badly needed.

The N. C. G. A. Annual Show.

There is a feeling in some quarters that because of the gas exhibit at the Panama-Pacific Exposition in San Francisco, and the generally unsettled business conditions, it might be well to omit the usual gas show at the 1915 Convention in Washington. The directors of the Association discussed this question at their last monthly meeting, and came to the conclusion that it would be a mistake not to have some kind of exhibit, even if only on a small scale. The feeling of the Board is that many gas men attending the conventions expect an opportunity to see and study the latest types of appliances.

It is said that facilities in Washington are not adequate for an exhibition on the scale that the Association has had heretofore, and a special committee has been appointed by President McLean to visit Washington and examine the situation in this respect and other matters effecting the Convention.

Resumption of Imports of Chemicals and Dyes.

According to the Commerce Reports of the Bureau of Foreign and Domestic Commerce, imports of chemicals and drugs, which were seriously interrupted in the first three months following the outbreak of the European war, have about resumed normal proportions. The November imports were valued at $7,904,944. against $6,746,147 in November, 1913; $8,042,567 in November, 1912, and $5,702,747 in November, 1911. The importation of chemicals, drugs and dyes has averaged $7,700,000 per month during the last five years, but in August it fell to $5,622,000, and in September to $5,519,000. With a partial reopening of trade channels there has been a marked increaae in imports of chemicals and drugs, rising to $7,382,082 in October and in November, as above noted, to nearly $8,000,000. Practically all lines of chemicals show larger imports in November than in any prior month of the current fiscal year, and many of them equal or exceed the imports in corresponding periods of earlier years. Of coal-tar colors and dyes the month's figures are double the normal average, being $1,081,000 in value, compared with $520,000 in November, 1913, and showing a marked recovery from the low-record figure of $233,000 imported in September. Alizarin and alizarin dyes, imports of which were greatly depressed in August, September and October, made a remarkable gain in November, the total being $414,642 as against $31,751 in November, 1913, and a monthly average of $145,000 in the calendar year 1913. Imports of indigo in November were 1,830,000 pounds, compared with 435,000 pounds in November, 1913. Creosote oil imports, which usually exceed three million and frequently range from four to five million gallons monthly, fell to less than one million gallons in October. In November, however, they rose to 5,108,000 gallons, as compared with 5,547,000 gallons in November, 1913, and 4,405,000 gallons in November, 1912.

A Joint Testing Laboratory.

The National Commercial Gas Association has asked the American Gas Institute to co-operate with it in making a canvas to ascertain to what extent gas companies and makers of appliances would support a central laboratory, to be available to the industry at large. This project and the announced intention of the N. C. G. A. to employ an Industrial Fuel Engineer, whose services and advice shall be at the call of its company members, are two lines in which the interests of the National bodies overlap, and where it seems easiest to get co-operation without waiting for the advent of the joint association. As the work of both the big societies broaden the duplication of work is more evident. We hope for an eventual organization on the lines indicated in the address of the President of the Wisconsin Association, on the first page of our issue of February 8th: "A joint National body with closely affiliated State and district associations."

GAS CONSUMER PLANT.

Mr. I. H. Sternberg is editor of "Light," a monthly magazine published for the employees of the Suburban Gas and Electric Club, Revere, Mass., and the following story in a recent edition of the magazine is the product of his fertile brain:

"Luther Burbank, the pomological and horticultural wizard, who has surpassed the late Bill Nye's scrambled egg plant by crossing red peppers, onions and tomatoes, and cultivating the plant in a soil composed largely of ground glass and cork, thereby producing a bush which bore tomato catsup already bottled, is a very clever man in his line. However, none of the hybrids have as yet proven of any great commercial value. Even the attempt of one of our officials to cross the humble milkweed with the wayside rum cherry in an endeavor to have an ever ready matutinal milk punch, had it been successful, would have been of little value in comparison with the revenue resulting from the distribution of two dozen Kohl Rabi plants which were brought to perfect growth in the co-operative kitchen garden at the Revere station. Now a Kohl Rabi is a vegetable joke. When first planted it is easier to answer the conundrum, 'What is it looks like a hen, has feathers and barks like a dog?' than tell what it is.

"It is not pleasant to the eye or particularly tittillating to the palate. It tastes like a boiled dinner without the corned beef, but as a revenue increaser it is equal to a ten suite apartment house. When full grown a Kohl Rabi has the stem of a cabbage, the top of a turnip and the long leaves of a cauliflower, and can be boiled soft as quickly as a well seasoned croquet ball. There were just 24 of them grown, and they were distributed to those employees whose curiosity as to the taste of a Kohl Rabi outweighed their judgment. Then the trouble began; the storekeeper was accused of receiving a commission from the company for every foot of gas used in excess of a stated amount and of having persuaded his unsuspecting fellow employees to cook his lignum vitae vegetable to make good. Charley Perry said his wife had cooked one of the Kohl Rabi nine hours and used 1,500 cubic feet of gas, and then it was just soft enough to cut with a knife and mallet. All the men in the gas shop said that they had found it impossible to boil Kohl Rabi tender under less than three days constant cooking, and then it was fit only to feed to a hen. Upon looking into the matter it was found that during the period that the Kohl Rabi were being taken home by the men the gas consumption increased from 311,000 cubic feet per day to 424,000 cubic feet, and this in spite of the fact that the beach season was almost over. A Kohl Rabi isn't a gas producer plant, but as a revenue maker for a gas company it's a wonder."

[OFFICIAL NOTICES.]

New England Association of Gas Engineers.

EAST BOSTON, MASS., February 10, 1915.

The Forty-fifth Annual Meeting of the New England Association of Gas Engineers will be held Thursday and Friday, February 18th and 19th, 1915, at Young's Hotel, Boston,

The following papers are to be read:

"Concrete Piles for Holder Foundations," by F. E. Drake, Lynn, Mass.

"B. T. U. Losses on Medium Pressure Lines," by W. O. Brewer, Meriden, Conn.

"New Vertical Settings at Fall River," by C. W. Hunter, Boston, Mass.

"Industrial Fuel Gas," by W. H. Bradley, Springfield, Mass.

"Free Maintenance of All Gas Lamps by Gas Companies," by J. P. Conroy, New York, N. Y.

"Coal Gas Candle Power," by L. J. Williams, Boston, Mass.

QUESTION BOX.

"What is the per cent. error in meters after 5 years' use with dry, moist, coal or water gas?"

"Is pipe welding done in New England?"

"How can trouble with service cocks on high pressure be overcome?"

"Is it feasible to heat houses by gas with hot air, steam or hot water systems?"

"Best way to burn water gas tar under boilers?"

"Best way of separating and handling water gas tar on make of 500 M. per day?"

"What saving in manufacture can be made by changing to a heat unit basis?"

"Repairs and depreciation, estimated and actual on the new systems of carbonization?"

"Best way to increase consumption among small consumers and to get water heater business?"

"What is being done in America to develop the chemical products of coal tar?"

Applications for Membership should reach the Secretary by Wednesday, February 17th, in order to be acted on at the meeting.

Members will dine together at Young's Hotel, at 6:30 P.M., Thursday, February 18th.

Mr. H. N. Tolles will speak at the dinner.

Members are urged to be prompt in attending the sessions at 10 A.M. and 2:30 P.M., Thursday, and 10 A.M. Friday. Please note the changes in date from the usual days.

N. W. GIFFORD, Secretary.

Indiana Gas Association.

OFFICE OF THE SECRETARY.
NEW ALBANY, IND., Feb. 4, 1915.

The Seventh Annual Meeting of the Indiana Gas Association will be held at the Claypool Hotel, Indianapolis, March 10th and 11th, 1915. The program arranged is as follows:

An Address, by a member of the Public Service Commission of Indiana.

"Appraisal of Public Utility Properties," by Wm. G. Woolfolk.

"Industrial Gas," by J. C. Shephard.

"Gas Rates," by J. H. Maxon.

"Application of By-Product Coke Ovens to the Gas Industry," by J. D. Forrest.

"Industrial Safety," by Chas. B. Scott.

"Comparative Costs of Gas and Electricity for Domestic Purposes," by B. K. Cash.

A special invitation to be present is extended to all who are connected with the gas industry in any State, and it would afford the officers and members of the Indiana Gas Association great pleasure if we could have a goodly number of visitors as our guests.

Those connected with the gas industry in Indiana are specially urged to be present—we need your assistance and your co-operation.

On the night of March 10th, a banquet will be served at the Claypool Hotel, for which a charge of $3 per plate will be made. This feature of our Association meeting promises to be unusually entertaining. JAMES W. DUNBAR, Secretary-Treasurer.

Illinois Gas Association.

OFFICE OF THE SECRETARY,
CHICAGO, ILL., Feb. 8, 1915.

The tentative programme for the eleventh annual meeting of the Illinois Gas Association, which will be held at the Hotel Sherman, in Chicago, on March 17 and 18, is as follows:

"Experience with a By-Product Coke Oven Plant as a Gas Producer," by C. C. Boardman.

"Inclined Retorts," by R. B. Richardson.

"Use of Exhaust Steam and Its Possible Economies in a Small Water Gas Plant," by S. A. Reinhart and C. A. Schneer.

"The Use of Lead Wool as a Jointing Material with Especial Reference to a 26-inch Main," by C. E. Reinicker.

"How the Shops Can Assist the Commercial Department in Promoting Friendly Relations with the Public," by H. E. Turner.

"The Immediate Gas Engine Business," by H. W. Edmund.

"Medical Work of the People's Gas Light and Coke Company of Chicago," by Dr. W. E. Post. HORACE H. CLARK, Secretary.

Pennsylvania Gas Association.

WEST CHESTER, PA., January 9th, 1915.

The Pennsylvania Gas Association, will hold their Annual Meeting in Philadelphia, on April 14th, 15th and 16th. The headquarters will be at the Hotel Adelphia, one of Philadelphia's leading hotels.

A splendid programme has been planned, including excellent papers by well-known men. The entertainment features are in the hands of gentlemen whose reputation has been established for something original and interesting.

It is hoped all members and their friends will be on hand, to make the meeting "Better than ever."

Yours very truly, W. O. LAMSON, JR., Secretary.

(*Continued from page 103.*)

Thirteen Years Operation of Inclined Retorts.

Joints of upper sections of retort were usually very wide, at times open 2 inches when bench was fired up the second time. There were no buck bars or rails across the upper mouthpieces, the rails being placed horrizontally between bottom, middle or top retorts at front of bench only. The retorts being inclined 32 degrees had a tendency to move toward the front, due to gravity, and the bars held them back. We added buck bars on several benches when mouth-pieces were coming loose.

Fig. 8.—Settings After Renewals.

Patching Lower End of Bottom and Lower Retorts. — When retorts are free of carbon in the mouth, very little starting of coke with poker is necessary, because bottom of retorts are smooth. At times charges will slip out when doors are open, before the stoker has chance to get to shield. Charges not thoroughly coked, or banked high against stopper, require the use of ¾-inch poker 10 feet long to get coke started, and assistance from stoker on charging floor. This poking of coke on discharging floor wears the retort about 12 inches above mouth-piece, and it becomes thin. Holes resulted, and repairs were made while bench was in use, by breaking out this thin piece and inserting a tile.

There was no occasion to repair top retort this way, as they were more in line with the poker used by the stoker. At no time during the operation of house were we unable to patch the leaks found. Not one retort was lost by falling in or sagging to a degree that rendered it useless. The retorts first installed were made of sections of equal length, and changed on renewing to 1 short length at bottom with longer lengths in center and at top. This was done to bring the lower joints closer to the end, making it easier to patch.

Fig 9 shows by dotted lines the sag in the first setting of retorts of bench 7, stack No. 2. The duration charts give the life and sag of each retort. Fig. 10 shows west top retort of bench 6, stack No. 1; used 6 years 10 months. Fig. 11 shows bench 7, stack No. 2, front lids open; Fig. 12, the charging end, and Fig. 13 east top retort looking down from charging end—the sag was 8 inches on east side and 9 inches on west side. This bench has a record of more than 10 years use, and while the sag was more than any other it was still serviceable. We had trouble in charging fine slack coal in these retorts, but no trouble with lump. We usually picked coal for this bench. It was hot enough when let down—March, 1914—to thoroughly carbonize 750 pounds of coal in 5 hours, the coal free of slack and dust.

There will always be straight and sagged retorts, more or less, and while charges placed and discharged in top and middle retort, like bench 7, stack No. 2, will take more time and work, it is not justifiable to cut out the bench, as the average time for 9 retorts, with 4 men, will not exceed 35 minutes. including trying of standpipes, cleaning off, closing and tightening up lids. Some men work faster than others, and 9 retorts have been drawn and charged in 20 minutes.

We used many grades of coal, which varied in regard to charging and discharging. With new benches we successfully used 30% nut and slack with 70% run of mine, getting uniform charges; but when benches began to sag it required poking down from the top. This increases the work, and stokers will neglect it if not watched. In charging coal with a large percentage of slack in retorts sagged 3 inches or more, we used a light sheet iron pan, 4 feet long with handle, placed in mouth of retort, and coal coming out of charger slid down this sheet iron surface and we were able to throw good charges to lower end of retort.

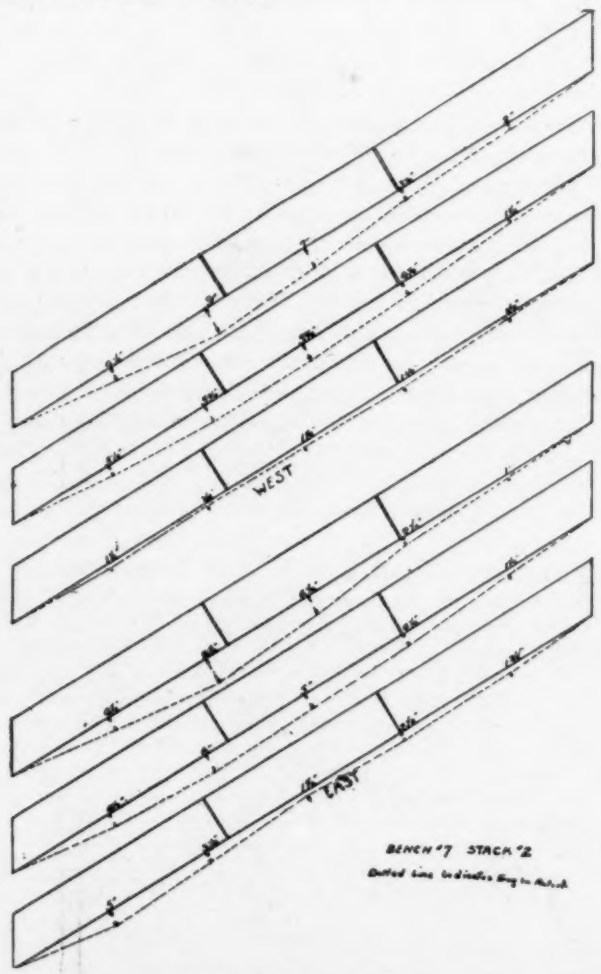


Fig. 9.—Sagging in Retorts.

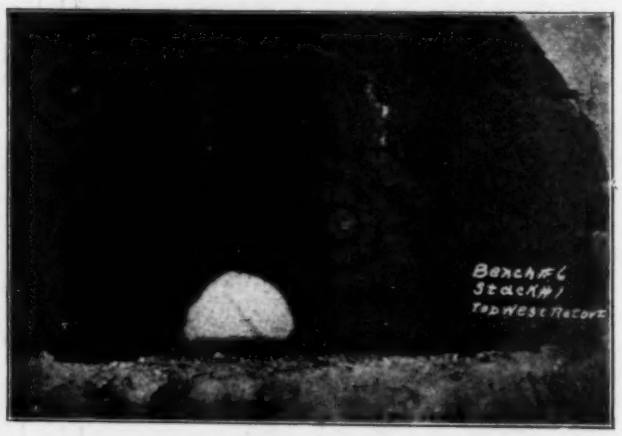


Fig. 10.—Cracks in Top Retort

We noticed at times, that charges after being uniformly placed would slip as much as 2 feet, causing the coal to thicken at the lower end. This we traced to two conditions:

1. When very fine slack and dust was pushed in with the poker from above, it would creep on a cold bench, with retorts of a temperature below normal, and not on a bench some hotter, indicating that more heat was needed.

2. When changing from one grade of coal to another harder and denser and requiring more heat to drive off all of the volatile matter, we would notice a slip even in lumpy coal, but we had no difficulty in overcoming it. We would run these particular benches over on longer hours until heats were brought up, when creeping would cease. No slipping was noticed with a soft grade of coal, even if heats were below normal. With the exception of slack, no grade of coal we used in the 13 years failed to carbonize successfully.

Standpipes.—Standpipes were of cast iron, 7 inches inside diam-

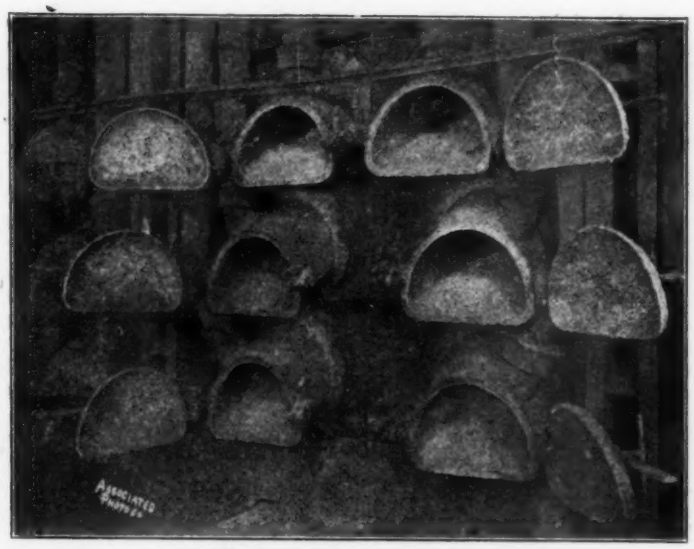


Fig. 11.—Front of Bench.

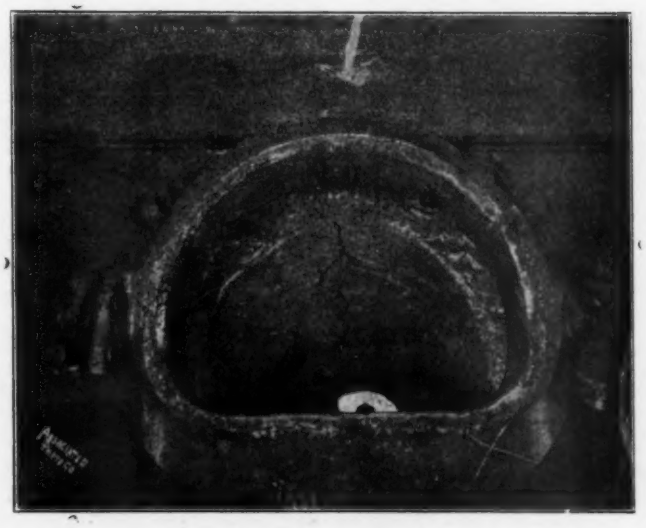


Fig. 12.—Top Retort.

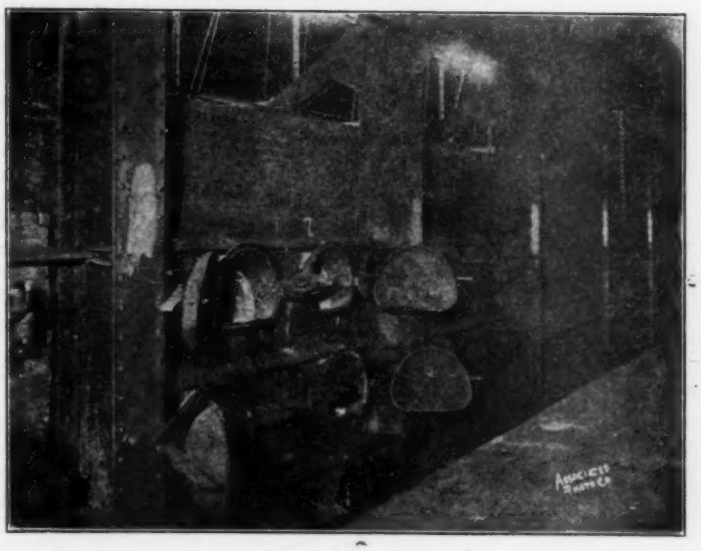


Fig. 13.—Back of Bench.

eter; lengths from bell on mouth-piece to flange on under side of bridge pipe, as follows: Top retort, 13 feet 6 inches; middle retort, 16 feet 4 inches; bottom retort, 19 feet 2 inches. In running on 4 hours with 625 pounds, we had trouble with stopped standpipes, attributed to excessive hot weather and high heats of benches. After charges were increased to 700 pounds, and then 750 pounds on 5 and 6 hours, we got along very well. Most of our trouble was due to hot weather, and it became necessary to put an extra man on each shift during the excessive hot days.

Stokers were required to run an auger up each pipe on every draw, and to open any pipe showing back pressure between draws. The standpipes on bottom retorts stopped up more than the middle and top ones, and they required an auger with a long handle which was not as easy for the stokers to manipulate. The stoppages were not much more troublesome than in the short pipes on the old horizontal benches, as most of them were close to the mouth-piece.

Coal Machinery.—We had break-downs of various kinds, none of which, however, held back the retort house. Our first was one of the 73 feet 2-bucket elevators which fell in a heap, causing the elevation of coal to be suspended until duplicate elevator started, holding work back 3 hours. As no coal is elevated on Sunday (having 48 hours supply) we took this day to straighten the buckets and renew the chain. The elevator was in order in 10 hours. Another break-down was caused by a piece of timber falling into boot of elevator, lifting the entire boot from its anchorage, and carrying it up two-thirds of the height of tower, before the machinery was stopped. No damage was done, outside of having to reset boot.

Renewals on the two elevators during the entire operation were, one new boot each, two sets of sprocket wheels, 60 feet of chain, 30 buckets, and the usual rebabbiting of boxes. The trough of the push conveyor made of 3/16-inch sheet iron was replaced 3 times, due to the constant slide of coal wearing it.

Breaker and Crusher.—Mine run coal used usually contained 30% of the coal already small enough and only coal larger than 1 inch cube was crushed. The breaker received the lumps larger than 4 inches, and the crusher reduced it to about ¾ inch. Breaker and crusher are of the 2-roll type, 30 inches in diameter, with teeth. No break-downs occurred during their use, but the crusher rollers had to be renewed in 5 years. The breaker was not renewed, only journal boxes rebabbited and shaft turned up. The 48 hours storage gave ample time for ordinary repairs on all conveyors, etc.

Charging Machines.—The charging machines were of sheet-iron, on 4 wheels, weighing empty approximately 2,500 pounds. Break-downs of chargers happened not more than once a year, such as wheels becoming loose, and derailing. When this happened during the night a few loads of coal will be missed on bench opposite charger, and the other benches are charged by shovel. A light chute is placed opposite bench to be charged, and coal is let out of bin on to charging floor, and charged into retorts by hand. Very good charges can be made this way, and while considerable longer time is required we were able to keep going while charger was being removed. There being 2 chargers to each stack, the 1 left did the work.

Coke Handling Machinery.—The task of moving coke from the retort house during break-down of hydraulic elevator was of no consequence, as cars were diverted into yard and unloaded, only requiring additional help. The method of moving hot coke from retort to quencher, and thence to coke house, required the usual amount of attention by the men to properly protect the cars and to thoroughly quench coke. We have had careless workmen dump hot coke in bin, and in one instance had to call on the fire department.

Results.—The results shown below cover 13 years:

Years.	Average yield of gas per ton.	Average yield of gas per pound.	Average candle power.	Gallons tar per ton coal carbonized.	Ammonia p r ton;liquid ounces.	Ammonia per ton, NH_2	Bench fuel in bushels per ton coal carbonized.
1901–02–03.....	9,864	4.93	16.66*	12.17	209.0	4.53	7.79
1904–05–06.....	10,001	5.00	15.62	11.13	237.3	5.13	7.79
1907–08–09–10..	10,109	5.05	15.06	12.02	244.5	5.29	8.07
1911–12–13.....	9,973	4.98	14.13	12.09	232.2	5.03	9.1
Total ave. 13 yrs.	9986.7	4.99	15.36	11.85	230.75	5.002	8.165

* Gas enriched three-quarter candle-power by oil benches.

They are based on coal bought by the bushel of 76 pounds (2,688 cubic inches), and on residuals sold. The coal carbonized was determined by adding stock on hand at the first of the year to coal bought, and substracting the stock at the end of the year.

For the 13 years the difference between that reported used by foreman and that bought was 4%; the greater part of the difference occurring in the latter years, being due to the stokers not getting the full charge load into retorts. We began weighing coal from shed to retort house in 1911, making weekly report of results. This worked out very close to the coal bought per year.

The yield of gas given was corrected to 60° temperature, and 30 inches barometer, candle-power taken with Sugg D burner and standard candle.

The course of gas from the retort house is as follows: 3/10 inch pressure in standpipes, foul main 300 feet to exhauster, through P. A. tar extractor, then to water tube condenser, to standard scrubber and oxide purifiers. During part of 1901, and all of 1902 and 1903, we had 2 oil benches of 2 retorts each, which enriched the gas about ¾ candle-power.

Bench Fuel.—The fuel consumed under benches is in bushels per ton of coal carbonized, as sales and all coke used were measured in bushels. Breeze used in boilers at work, not included in determining bench fuel used. Over 75% of the coal carbonized was from the Pittsburgh district, known here as 2nd. and 4th. pool coal. The balance of coal used was local coal, and some from the bordering states. The coke made was estimated by using a coefficient—0.0166 times pounds of coal carbonized equals the bushels of coke.

The life of retorts shown in duration sheets was the time in actual use. During half of 1911 to March, 1914, labor was changed from 12-hour shifts to 10 hours, leaving a gap of 2 hours on each watch included in life of retorts.

The following results are a fair average from 1900 to 1910, the maximum and minimum months of 1902 and 1910.

December, 1902.

Make per Retort per Day Cubic Feet.		Make per Bench per Day (16 Benches). Cubic Feet.
17,448	Maximum	104,688
15,927	Minimum	95,562
16,640	Average	99,840

Average make per stoker per day, 99,840 cubic feet.

August, 1902.

Make per Retort per Day. Cubic Feet.		Make per Bench per Day (13 Benches). Cubic Feet.
15,641	Maximum	93,846
12,090	Minimum	72,540
13,850	Average	83,100

Average make per stoker per day, 67,518 cubic feet.

December, 1910.

Make per Retort per Day. Cubic Feet.		Make per Bench per Day (16 Benches). Cubic Feet.
15,882	Maximum	95,292
13,157	Minimum	78,942
14,300	Average	85,800

Average make per stoker per day, 91,162 cubic feet.

August, 1910.

Make per Retort per Day. Cubic Feet.		Make per Bench per Day (14 Benches). Cubic Feet.
14,952	Maximum	89,712
12,464	Minimum	74,784
13,760	Average	82,560

Average make per stoker per day, 72,240 cubic feet.

Report of the Director of the Bureau of Standards.[1]

Since the Bureau of Standards deals almost entirely with scientific and technical problems, the following brief statement as to its functions and organization may be of assistance to those unfamiliar with its work.

The standards with which the Bureau is authorized to deal are: I. Standards of measurement; II. Standard values of constants; III. Standards of quality; and IV. Standards of mechanical performance.

1. *Standards of Measurement.*—A standard of length may be taken as an example of a standard of measurement. It must be a length which is unchanging, reproducible, and capable of being compared with the working standards used in the most precise scientific work or with those used in commerce and industry. The fundamental standard must be subdivided, and working standards of these parts prepared; for the measurement of greater lengths, standards must be prepared that are multiples of the fundamental standard. This process of subdividing and multiplying the standard involves even more difficulties than the preparation of the fundamental standard itself. The construction of a set of standard weights from a single unit is an illustration, but a whole set of standard weights must be prepared before the standard weight of the Government can be available to the public. When the standard of length or weight has been made, and before the working standards of the subdivisions or multiples can be prepared, the question as to the method of comparison arises, which also involves the solution of difficult scientific problems in connection with the balance or the methods used. The balances range from that capable of measuring the thousandth part of a milligramme to the large machine capable of measuring a load of thousands of tons. The complete range must be covered, which involves not only a large number of working standards, all of which must agree with the fundamental standard, but apparatus suitable for the comparison of these standards with all the weights used in practice. These steps and equipment are absolutely essential in order to secure uniform measurements throughout the country, and they have their counterpart in every quantity that has to be measured, whether it be length, weight, temperature, heat, light, various electrical or other measurements. These standards in one form or another are involved in practically every scientific investigation, industrial process and engineering structure.

2. *Physical Constants.*—There are many fixed relations between physical quantities which it is important to know. These values are usually termed "physical constants," and are used in every branch of scientific work. The quantity of heat required to change a pound of water into steam, and the relation between heat and mechanical energy are two important physical constants used in every computation in connection with the designing of steam engines and boilers, and tests of their efficiencies. The heat required to turn liquid ammonia into vapor or that required to melt a pound of ice are important in the refrigerating industries. The value of the relation between electrical and mechanical energy is involved in many important commercial transactions. Accurate and authoritative values of these constants are as essential as standards of measurement. Many of those now in use are old and obsolete and need redetermination by the best modern facilities for physical measurement. Their determination involves most difficult and precise work in all branches of physics and chemistry.

3. *Standards of Quality.*—A standard of quality for a material may sometimes take the form of a sample of that material with which other specimens can be compared, but that is generally a make-shift of the poorest sort and only resorted to in the absence of definite and reliable specifications in terms of measurable properties. That is to say, a standard of quality of a material usually takes the form of a specification or definition of its properties, involving, of course, the measurement of these properties. A certain kind of steel, a cement, a paint, an oil or a paper or cloth is found by use to be good or bad. The question then arises, Why is it good or bad; what are the physical or chemical properties or the particular combination that make it so; how are its properties to be measured or its constituents determined? These are for the laboratory to determine, and involve physical and chemical investigations of the most difficult sort.

A standard of quality for any material necessarily takes into account the purpose for which it is used; to set the standard too low results in losses, and poor efficiency; to make it too high may result in precisely the same things. The Bureau's investigations are to enable the user of materials to select intelligently those best suited for the purpose; to specify it in terms which the producer cannot mistake; and to make the necessary tests to ascertain whether the material supplied is in accordance with the specifications.

The testing of materials by the Bureau of Standards to ascertain whether they comply with specifications is confined to Government purchases, and in making these tests it is compelled to make many investigations of the properties of materials, their specifications and measurement. While this work is of great value in placing Government contracts, the information gained in testing Government supplies are even more important to the general public, and are therefore distributed in the form of bulletins.

The Bureau does not compete with private testing laboratories but endeavors to assist them by the development of standard specifications, methods of measurement, and other matters where uniformity is desirable.

The time is not far distant when it will be required that all materials bought and sold be as represented, but this is impossible except with those materials for which proper standards of quality and methods of measurements have been developed. It must not be assumed that the purchaser or user is the only party benefitted by the development of such standards; on the contrary, the manufacturer, first of all, is interested in all things that effect the quality of his product, and, while the Bureau's efforts in this field are de-

1. From Circular No. 52.

voted principally to the pointing out and measurement of these properties, it is to be regretted that its force and equipment are insufficient to assist manufacturers in improvement of the process upon which the quality of the output depends.

4. *Standards of Performance.*—The value of an instrument or machine depends upon the efficiency of its performance, and it is necessary to state the performance desired or guaranteed in terms succeptible of measurement. Like standards of quality, the requirements are often in the form of specification, but these are useless unless based upon correct scientific and mechanical principles, and supplemented with a statement of the method to be used in ascertaining whether the guarantees are complied with.

Relation of the Bureau's Work to the Public.—It is obvious, even to one unfamiliar with the subject, that the maintenance on the part of the Government of correct standards calls for continuous scientific and technical investigations or the hightest grade, involving the competent expert services and the best scientific equipment. When this is accomplished, there still remains the serious problem of making the results available and useful to the public.

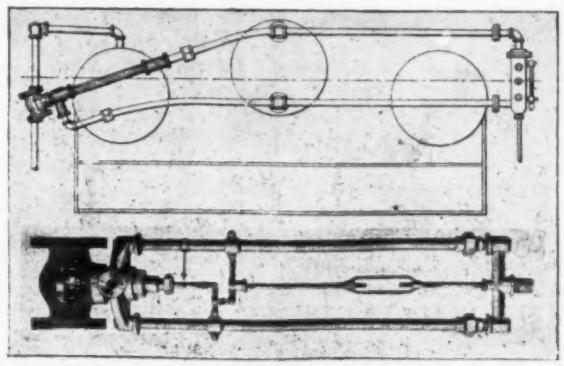
The Bureau compares with its own standards, the standards or measuring instruments of States, cities, scientific laboratories, educational institutions, manufacturers, Government bureaus; etc., charging nominal fee except to National and State institutions. It gives advice on standards and their use, in connection with the enactment of laws and ordinances concerning the weights and measures of everyday trade, or precision standards used in scientific work and the industries. It gives advice upon request to State and city officials, public service commissions and public utility corporations, regarding standards of measurements, quality and performance. Many questions between public and utility companies as to these matters are referred to the Bureau for advice or adjustment, often avoiding unfair or inconsistent regulations, as well as long and expensive litigation. There is great need for unbiased and reliable information pertaining to the standards entering into the regulation and sale of the services of public utilities and such information is given by the Bureau in the form of publications upon definite subjects. It must not be inferred that the Bureau's activities are devoted principally to the interests of the user or consumer. The fundamentals regarding standards of measurement, quality and performance deeply concern manufacturers, and they are daily concerned in improvements of methods of production and the quality of output. It may be said that the Bureau occupies somewhat the position with respect to manufacturers that the bureaus of the Agricultural Department do to the agricultural interests. Many industries are just beginning to realize the importance of precise methods and scientific investigation, which, in practically every case, involve some kind of measurement.

It is upon quality as well as upon price that competition must finally depend both in domestic or foreign commerce. The use of exact methods is the greatest factor in the improvement of quality and efficiency, and the development of new industries. The educational value of the Bureau's work in this respect is almost unknown to the general public, and yet we receive hundreds of letters as well as many personal visits from manufacturers seeking information on standards, how to use them, how to determine the properties of materials, or as to the fundamental physical and chemical principles involved; and, what is of even greater importance, how to initiate and carry out scientiffc investigations and tests on their own account in their particular field of work.

The importance to the industries of maintaining scientific institutions having to do with standardization and the application of precise measurements has been recognized by all the leading countries of the world. Great Britain maintains the Standards Department of the Board of Trade, which is in charge of the standards and inspection service of the trade weights and measures; also the National Physical Laboratory, whose functions include matters pertaining to scientific and technical standards, physical constants and to some extent the properties of materials. The Laboratoire d'Essais, of France, while not as extensive as the English institution, is charged with similar duties. Germany maintains three such institutions—the Normal-Eichungs Kommission, equipped with the buildings, personnel and apparatus necessary in standardizing and controlling the weights and measures of trade; the Physikalisch-Technische Beichsanstalt, covering testing and investigations in connection with scientific and technical standards other than weights and measures; and the Prussian Government maintains the Material-prüfungsamt, an institution devoted to the investigating and testing of structures, engineering and other materials. It is generally recognized that these institutions have been exceedingly important factors in the industrial progress of these countries.

New Methods and Appliances.

THERMOSTATIC FEED WATER REGULATOR.—The McDonough Automatic Regulator Company is manufacturing an automatic feed water regulator of the thermostatically controlled type, designed to secure continuous feed and to vary automatically in proportion to the load the quantity of water fed to the boiler. The rate of feed is made proportional to the evaporation and a practically constant water level is maintained for light and uniformly varying loads. Sudden increases in the load, accompanied by a resulting rapid drop in the water level, do not cause the regulator valve to open suddenly and admit a large quantity of water into the boiler, as there is a time element in the expansiou of the tubes operating the valve which uniformly increases the water fed. This arrangement is calculated to allow the immediate furnace heat to be used for the evaporation of the water already in the boiler, not for heating a large quantity of cold water.



Feed Water Regulator with Automatic Thermostat Control; Complete Device Below and Method of Installing Above.

The regulator comprises two headers and two expansion tubes connected in parallel through rigid links to the stem of the feed valve. As indicated in the cut, under ordinary operating conditions, the lower ends of the tubes are filled with water and the upper with steam. Changes in the water level in the boiler produce corresponding variations in the regulator tubes and present a greater or less portion of the tube surface to the hot steam, causing them to expand or contract accordingly. The inclined position of the regulator is to give maximum variation in exposed tube surface for variations in water level and corresponding sensitiveness to variations in load.

HARD CONCRETE FLOOR.—A system used extensively to give a hard and dustless surface to concrete floors consists essentially of removing the surplus water from the upper layer of the placed concrete, so that the surface may be finished before the cement has commenced to set. The usual methods are employed until the wearing surface is struck off level. Then burlap is laid upon the concrete, and cement and sand (or other fine aggregate) dry mixed in the proportions for the wearing course of the floor, are shoveled on top of the burlap and spread to a uniform thickness of about ½ inch. Capillary attraction acts to draw the surplus water from concrete through the burlap into the dry mixture, and only a very few minutes are required for this action. Then the burlap is lifted and the material upon it dumped into the mixing box where additional water is added, so the material can be used for the wearing course of other sections of the floor. In this way no material is wasted. As soon as the burlap is removed from the surface of the floor, the finishers proceed with their work. Under average conditions a floor finished by this method will support the finisher's weight within 15 minutes after the wearing surface has been placed, struck off level, and relieved of the surplus water. It is believed that the dusting of concrete floors is caused by the breaking up of partially formed cement crystals made by finishing the concrete after the cement has commenced to harden.

THE largest steel stack in the world is that in the new Equitable Building in New York city. As described in *Engineering News* of Nov. 12, it is 596 feet high and 11 feet outside diameter. It is made of 5/16-inch steel plates, and is supported by the steel work of the building at every other story. The lining used is formed of alternate layers of plain and corrugated asbestos board coated with a supposedly vitrified compound in curved slabs about 45 by 35 inches by 2 inches thick.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. O. B. OSTHOFF, Vice-President and Chief Engineer of H. M. Byllesby & Company, announces the appointment of F. H. Lane, as Manager of that firm's Department of Examinations and Reports. Mr. Lane has been with Byllesby & Company for nearly 11 years and has participated in many of the important investigations and appraisals made by the department of which he became the head February 1. His appointment is a recognition of continuous efficient service and a capacity for the responsibilities inseparable from an extremely difficult branch of professional work.

STOCKHOLDERS of the Detroit City Gas Company, at their annual meeting, elected the following Board of Directors: Emerson McMillin, Victor F. Dewey, Alanson P. Lathrop, George H. Russell, George E. Lawson, Frank P. Byrne, Henry E. Bodman, Homer Warren, Alonzo P. Ewing. The Directors named these officers: President, Emerson McMillin; Vice-President and General Manager, Victor F. Dewey; Vice-President, Alanson P. Lathrop; Assistant General Manager, Alonzo P. Ewing; Secretary and Treasurer, Charles S. Ritter; Auditor, Henry W. Sherriffs, Assistant Treasurer, John M. Wright; Assistant Secretary, C. N. Jelliffe; Assistant Auditor, James Lawrence; Consulting Engineer, H. C. Abell.

A MOND gas plant is being installed at the Fushun coal mines, in Manchuria, to supply power for generating electricity. The plant has been designed for the recovery of ammonia sulphate, Fushun coal being particularly suitable for this purpose, and it is estimated that 250 tons of coal will be gasified per day, and that there will be a daily yield of about 12 tons of sulphate. The intention is to sell the sulphate in Japan or California.

MR. W. R. HALL, Manager of the Anniston (Ala.) Electric and Gas Company has resigned and is succeeded by Mr. A. L. Kenyon, of St. Louis, Mo. Mr. Hall succeeded R. L. Rand as Manager of the company, about one year ago, and has won the confidence and friendship of the people of Anniston since he has been in charge there.

AT the annual meeting of the Consolidated Gas, Electric Light and Power Company of Baltimore, President J. E. Aldred was made chairman of the Board of Directors; Mr. H. A. Wagner, former vice-president in charge of Electrical division, was elected president: Mr. C. M. Cohn, vice-president in charge of Gas Division, had his authority extended to cover both gas and electric departments; and Mr. J. L. Bailey and Mr. Wm. Schmidt, Jr., were re-elected treasurer and secretary respectively.

THE week beginning April 12th will probably be a busy one in Philadelphia. It is planned to have the New Jersey State Gas Association meet with the Pennsylvania Association, and have the Philadelphia Gas Meeters show them the way toward "Good Fellowship."

WITHIN a few days it is probable that 300 men will be put to work by Manager John J. Kirkpatrick of the Holyoke (Mass.) Gas and Electric Department in digging up the gas mains that are to be replaced. The original plan was to start this work as soon as the frost was out of the ground, but because there are hundreds of unemployed, Manager Kirkpatrick has decided to proceed with the work at once. Holyoke is following out a plan inaugurated in Duluth and other Western cities a few years ago, for doing all municipal work that is possible in the winter when employment is much harder to obtain than in the summer.

THE D. R. Russell Engineering and Development Company announces that its staff now consists of the following: D. R. Russell, President and General Manager; J. L. Green and F. G. Curfman, Vice-Presidents; R. D. Hatton, Treasurer; Irwin Rawson, Secretary; Vernon Baker, Chief Engineer. Mr. Russell, prior to his resignation from the Parker-Russell Mining and Mfg. Co., was for many years employed by that company and for the last 7 years was President of it, and had charge of the sales, engineering and construction departments. Mr. Baker and Mr. Rawson were also employees of the Parker-Russell Co.; Mr. Baker having been chief engineer for a number of years, and Mr. Rawson assistant to the President. Mr. F. G. Curfman was connected with the Improved Equipment Co., of New York, and for the last 4 years with the Gas Bench Sales' Department of the Laclede-Christy Clay Products Company. The wide experience of their staff and intimate knowledge of gas works' construction, including extended information on existing plants, puts them in an exceptional position for carrying on the work of constructing carbonization installations.

THE Southern Gas and Electric Corporation, of Baltimore, Md., has filed with the Common Council of Richmond, Va., a second proposition looking to the leasing of the municipal gas plant, on a basis combining the elements of municipal ownership and private control. Two propositions are presented; the first provides for a lease for 30 years, at a rental of $140,000 a year, plus a tax of 1% on the annual gross receipts, the rental to be in lieu of interest and all city taxes on the gas plant as now constituted or later enlarged. The company is to expend $1,000,000 in bringing the plant and distribution system to the highest standard of efficiency. At the expiration of the lease the extensions and enlargements are to be taken over by the city at a fair valuation. The alternative proposition is a lease for 30 years under an agreement which includes these principal conditions: The payment to the city annually of $100,000; the company to expend as promptly as reasonably possible, such sums as may be necessary to bring the plant and distribution system to the highest state of efficiency, the preliminary estimate being not less than $1,000,000, and, in view of annexation probably considerably more; after the payment of $100,000 rental and interest on the fairly expended outlays for enlargements the remaining profits to be divided equally between the city and the company.

THE reinforcement of its distributing system, says John W. Ellis, president and manager of the Providence (R. I.) Gas Company, is the reason for recent purchase of land in the Olneyville section. In order to obtain this reinforcement the district holder system has been adopted by the company and about April 1 three or four gangs of men, now unemployed, will start work on the first line of pipe from Sassafras Point to the new property on Hartford avenue. The gas is to be turned on about October 1. Later another line will be laid to a point in Cranston, near the City Hall, to supply a district holder in that location and give better pressure in that vicinity.

THE Kalamazoo (Mich.) Gas Company at its annual meeting decided to spend many thousands of dollars this year for general improvement of the service. The officers were re-elected as follows: President, B. C. Cobb; F. W. Blowers, vice-president and general manager; J. J. Knight, 2d vice-president; W. H. Barthold, 3d vice-president; E. W. Shaw, secretary; H. C. Edmunds, treasurer; S. E. Wolf, assistant secretary and treasurer.

MR. R. H. CUNNINGHAM, who has been manager of the Nebraska City Gas Company, is now manager of the Madison (Ind.) Light and Fuel Company. It is probable that B. P. Egan, manager of the Water and Light Company at Nebraska City, will take the place of Mr. Cunningham handling that work in addition to his present duties.

ABOUT 30 employees of the Meriden (Conn.) Gas Light Company assembled at Hobson's Alleys last week for a Dutch supper, with bowling, pool, etc. Several vocal selections were rendered during the evening by H. Levine. and by the company's quartet. Among those present were: C. Griswold, J. L. Goodwill, D. Clark, E. Everard, W. Dunlop, S. Brecker, D. Poncello, J. Smith, B. Sala, J. Godburn, G. Warren, J. Maslow, A. Bullock, A. Godburn, H. Levine, H. Learned, A. Arnold, P. Kenney, C. Greenhouse, S. Greenhouse, E. Schulkie, W. Ferguson, E. S. Fowler and Mr. Learned.

MR. W. H. LEVINGS, secretary of the Minneapolis (Minn.) Gas Light Company, has a unique collection of about 500 coins, each representing an attempt to beat the company out of a quarter's worth of gas. In the assortment is everything from a pants button to foreign money. The countries represented are Canada, China, Germany, Mexico, England, Roumania, Greece, India, Chile, France and Prince Edward's Island, the value ranging from one cent to twenty-five. The vulgar beer chip is in the majority. There are pressed paper, lead, brass and aluminum slugs and in almost as many shapes. Washers, sufficient to supply the family auto for the coming season, are in the collection, and if they give out there is still the Chinese money to draw on. Counterfeit and plugged or mutilated quarters form a prominent part of the curios. Three trouser buttons form the smallest classified section of the exhibit, and several lead weights taken from women's garments are found.

A clock wheel and a broken key stand out conspicuously. Other articles are tiddlewinks, pieces of jewelry, disks of cardboard, a quarter in two portions, ancient two-cent pieces, nickels flattened to resemble two-bit pieces and a circular tin slug carefully wrapped in paper and tied with a thread.

THE new plant of the Muscatine (Ia.) Lighting Company will be completed in about another week. The new building is practically completed, all the heavy machinery was installed before the walls were erected and during the time the building was in course of construction the machinery was fitted up. Trial tests of the plant can be made any time. The new installation will greatly facilitate the making of gas and increase the capacity of the plant.

DURING 1915 the Consumers Gas Company, Reading, Pa., will expend $325,000 for improvements, including a new holder and main extension from Wyomissing to Sinking Spring, besides a number of extensions within the city limits. "Of the 23,000 buildings in the city and suburbs," said Superintendent John H. Keppelman, "the company supplies 70% with gas. During the year 1914 we sold 385,000,000 feet of gas. There are 12,000 gas stoves in use and 8,000 water heaters. When we took over the plant of the Reading Gas Company in 1885, it had 3,500 meters and an output of 40,000,000 feet of gas a year. To-day there are 20,000 meters and the consumption of gas totals about 385,000,000 feet."

AT the annual meeting of the Employees' Association of the Pittsfield (Mass.) Coal Gas Company. officers for the ensuing year were elected as follows: President, Horace Trego; Vice-Pretident, Michael Connors; Treasurer, Nelson Moore; Secretary, John J. Quinn; Editor of "The Illuminator," Clarence E. Moore; Executive Committee, Francis Connor, Harry C. Crafts, David C. Cullen, Jr. Peitro Orsi was chosen custodian of the graphaphone and George R. Nixon custodian of the base ball outfits. After the business session, Mr. Trego read a paper on "The History and Manufacture of Water Gas." Refreshments were served.

THE Consumers Power Compapy has announced a reduction of its gas rates in Faribault, Minn., from $1.30 to $1.10, to conform with the rate made at Mankato. The rate for Northfield has been cut from $1.44 to $1.25. The gas is pumped to that city from Faribault.

THE Milwaukee (Wis.) Gas Light Company has donated $1,000 worth of gas coke to the city's needy, and has had circulars printed in Polish and German containing instructions as to its proper use and has placed them with the Associated Charities for distribution.

MANAGER THOMAS T. LOGIE, of the Westfield, Mass., municipal plants, recommends lower rates for large consumers of electricity or gas. The rates were lowered about a year ago, and the department still shows a good profit. A rotary scrubber for the gas department is suggested for increasing the efficiency of the plant, and a coal handling device would save much time and expense. There are now 2,632 gas consumers, an increase of 133, and 1,911 use prepaid meters. The cost to date of the two plants is $412,986; the inventory shows assets of $218,566. The gas output was more than 46,000,000 cubic feet, and the manufacturing cost was $29,-208. The income for sales of gas was $44,600; coke, $6,586, and tar, $2,330. In the electric department the income was $41,355.

MR. L. R. DUTTON, President of the Pennsylvania Gas Association, and Grand Commissioner of the Gas Meeters, has added Sire to his other titles. Miss Barbara Roberts Dutton was born February 2d, and Mr. and Mrs. Dutton are receiving the congratulations of their friends.

ARTICLES of incorporations of the Utah Valley Gas and Coke Company have been filed. The company succeeding the Utah Vallep Gas and Power Company, will manufacture, sell and distribute gas, electricity, coke, tar, ammonia, etc., and engage in all business incident thereto. Provo, Utah, is named as the principal place of business. The authorized capital stock is 7,000 shares of the par value of $100 each; 2,000 shares are preferred, entitled to a cumulative dividend of 7% annually. The incorporators, directors and officers are: Fred W. Freese, President; Frank B. Stephens, Vice-President; Isaac B. Evans, Chairman of the Board; Mary A. Perry, Secretary; Herbert M. Chamberlain, Treasurer. Of the paid up capital stock Fred W. Freese holds 1,496 shares, and the other incorporators 1 share each.

UTILITIES COMMISSION NEWS.

GAS RATES UPHELD AT EL RENO, OKLAHOMA.—The State Corporation Commission of Oklahoma has dismissed a case brought by the City of El Reno to secure a reduction in the gas rates charged by the El Reno Gas and Electric Company. According to the Commission the showing made by the company proved the rate of $1.50 per thousand feet to be no more than sufficient to yield a fair return on the investment.

IDAHO COMMISSION.—W. D. Standrod, of Pocatello, has resigned as a member of the Idaho Public Utilities Commission for personal reasons. The Commission has rendered decisions reaffirming its determination not to grant certificates of public necessity and convenience to companies to enter a field which is being adequately served by the existing company. The decisions had reference to the application of tbe Idaho Power and Light Company and Clear Lake Power and Improvement Company to enter the field supplied by the Great Shoshone and Twin Falls Water Power Company in the counties of Twin Falls, Gooding and Lincoln.

ARKANSAS WANTS A UTILITY COMMISSION.—The Arkansas Railroad Commission may recommend to the Legislature that the commission be enlarged into a public utilities commission with authority to regulate the operation of all public service corporations. Members of the commission, accompanied by T. E. Wood, of Marianna, who became a member of the board January 11, succeeding G. T. Breckenridge, of Paragould, conferred with Governor Hays relative to such a recommendation.

NEW COMMISSIONERS.—The Wisconsin Senate has confirmed the appointment of Mr. Carl D. Jackson, of Oshkosh, to succeed Mr. John H. Roemer on the Railroad Commission.

The name of Mr. Walter Alexander, of Milwaukee, has been sent to the Senate for confirmation as member of the Railroad Commission to succeed Mr. David Harlowe. For the last 5 years Mr. Alexander has been district master mechanic for the Chicago, Milwaukee & St. Paul Railway Company, with headquarters at Milwaukee. Previously he served on the faculties of the University of Wisconsin, Armour Institute and the University of Missouri.

Mr. Walter H. Gaithes, who has been appointed a member of the Public Service Commission of Pennsylvania by Governor Tener, will serve for a term of 2½ years, beginning on Jan. 19, 1915. Mr. Gaither was born in Foxburg, Clarion County, Pa., 45 years ago, and was engaged in newspaper work in Pittsburgh for several years. He was secretary to Governor Tener during his term as congressman and served in the same capacity during Mr. Tener's term as Governor.

Mr. Beecher W. Waltermire, of Findlay, has been appointed a member of the Public Utilities Commission of Ohio, to succeed Mr. E. W. Doty, whose term has expired. Mr. Waltermire is an attorney. His name had not been mentioned for the position and the announcement came as a surprise since several other men were avowed candidates.

TO LIMIT PENNSYLVANIA COMMISSION.—The Municipal Home Rule League, which is back of the Graff-Maurer bill to repeal the Pennsylvania Public Service Commission act, has decided to offer another bill which would provide for a commission with limited powers. Under this plan there would be a commission of five men with duties restricted to the supervision of common carriers and other public utilities serving in the State at large. Local authorities would have jurisdiction over the affairs of local companies. At the meetings of the league it was pointed out that the expense of sending witnesses to Harrisburg to meet with the commissioners was so great in many cases that justifiable complaints could not be made.

ACTING WITHOUT AUTHORITY.—Calling attention to the fact that the Southern Counties Gas Company paid $20,000 in dividends in 1912 and 1913, and suggesting that stockholders of the company might properly finance a portion of the concern's indebtedness, the State Railroad Commission has denied an application to pledge its 3-year notes as security for $12,000 in promissory notes, alleged to be due for operating expenses; and also issued a statement regarding the concern's pledging of $10,000 in notes, sometime ago, without authority.

"It is not our belief that this commission should appear to quibble over a matter that may not in itself be of very great consequence, but it is also our belief that this commission should and must insist upon a full and complete compliance with the provisions of the Public Utilities Act."

Financial Notes.

THE stockholders of the LAWRENCE (Mass.) GAS COMPANY have been notified that the company has increased its capital stock from the par value of $1,900,000 to $2,500,000. Shareholders of record, June 4, 1913, on which date the increase was voted, may subscribe to the 6,000 new shares at 140 at the rate of one share of new stock for every three and one-sixth old shares. Assignments of the right to subscribe for the new stock will be recognized by the company. The right to subscribe will expire Feb. 13, 1915, and subscriptions must be paid for by Feb. 17.

RETURNS for three months ending Dec. 31, 1914, made to the the City Treasurer, by the PAWTUCKET (R. I.) GAS COMPANY, representing 2% of the gross earnings of that company for the last quarter, amounted to $1,364.40. The gross earnings according to the return were $68,220.16.

THE Board of Public Utility Commissioners has approved an issue of $190,000 first refunding morgage 6% bonds of the NEW JERSEY CONSOLIDATED GAS COMPANY.

BUSINESS of the PUBLIC SERVICE COMPANY OF NORTHERN ILLINOIS for the year just ended showed steady gains, and the company closed the year with over 112,800 customers at its various operated properties. Of these, 54,850 were electric consumers, 52,609 gas consumers, 4,293 water consumers and 1,056 heating consumers. The company serves 153 cities and towns, and has 13 electric generating stations, 7 gas plants, 7 water plants and 5 heating stations.

THE AMERICAN GAS COMPANY reports for year ending December 31, 1914, as follows:

	1914.	1913.
Gross earnings	$3,764,837	$3,410,971
Net earnings	1,797,133	1,621,569
Surplus after dividends	177,403	258,930

THE net earnings of the WASHINGTON (D. C.) GAS LIGHT COMPANY for 1914, as reported at the annual meeting, amounted to $559,129.40, compared with $626,121.23 in 1913. The assets of the company were set forth as totaling $14,255,812.29, with capital stock outstanding of $2,600,000, and a corporate surplus of $6,787,836.51. The total net revenue was $916,486.14, from which deductions for taxes and uncollectible bills amount to $168,865.76, leaving a net operating revenue of $747,620.38. Other income of $19,381.49 swelled the gross corporate income to 767,001.87. Deductions for interest $202,929.79 and miscellaneous charges made net income $559,129.40. The operating revenues were: Sales of gas, $2,197,363.14; coke; $12,110.93; residuals, $8,420.93, and miscellaneous, $1,541.11, or a total of $2,219,436.11. The operating expenses included production expenses of $920,142.69; transmission and distribution, $146,723.73: street and park lighting, $6,693.79; commercial, $92,850.73, and general and miscellaneous expenses, $140,175.35, or a total of $1,306,586.29. No change was made in the company's directorate, the members of which include Howard S. Reeside, Joseph Leiter, Ord Preston, John D. McIlhenny, James M. Green, Guy F. Whiting and Daniel Fraser.

EARNINGS STATEMENT CITIES SERVICE COMPANY.

	12 Months Ending Dec. 31, 1914.	12 Months Ending Dec. 31, 1913.	Month of Dec., 1914.	Month of Dec., 1913.
Gross earnings	$3,934,453.37	$2,172,411.11	$404,807.91	$413,861.65
Expenses	116,908.29	85,347.95	12,044.65	3,897.31
Net earnings	3,817,545.08	2,087,063.16	392,763.26	409,964.34
Interest on notes	420,000.00	123,062.27	40,833.34	29,166.67
Net to stock	3,397,545.08	1,964,000.89	351,929.92	380,797.67
Dividends Pref. Stock Paid and Accrued	1,635,993.50	908,777.60	130,833.00	136,822.87
Net to common	1,761,551.58	1,055,223.29	221,096.92	243,974.80
Dividends Com. Stock	471,047.68	466,426.21		65,456.75
Net to surplus	1,290,503.90	588,797.08	221,096.92	178,518.05
Surplus reserve	158,087.25			
Surplus	3,278,497.98			
Total Surplus	3,436,584.33			

12 Months ending	Net to Stock.	Ratio "Net to Stock" to Preferred Dividends paid and accrued.	Per cent earned on average amount of Common stock outstanding.
Dec. 31, 1911	922,032.59	176.80	8.23
June 30, 1912	1,023,436.52	180.86	8.81
Dec. 31, "	1,113,732.61	183.82	9.29
June 30, 1913	1,364.299.67	198.67	10.16
Dec. 31, "	1,964,000.89	216.11	10.71
June 30, 1914	3,010,139.84	223.17	11.67
Sept. 30, "	3,330,110.39	212.21	11.55
Dec. 31, "	3,397,545.08	207.67	11.28

Preferred Stock outstanding	$26,168,426.00
Common " "	14,718,380.00

The decrease in outstanding stock is occasioned by the re-delivery to the treasury of certain stock held to finance the purchase of the stock of the St. Joseph Company, the balance due now being put into bills payable extending over a period of 2½ years.

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